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EDITORIAL NOTES—GAS, &c.

Dessau Vertical Retort: The Additional Metre.

THE evolution of carbonizing systems and of the resulting economies is a fascinating study for all gas engineers; and therefore the further contribution to the subject which Mr. E. Körting has made, and which was published in our columns last week, is of extreme interest and value. It is so for more than one reason. Few engineers have had under their charge the same variety of retort-house methods as Mr. Körting, up to and including extensive installations of inclined retorts; none has had his experience in carrying the Dessau vertical retort system beyond the point at which it left its native town. Further, bearing upon this last sentence, the contribution throws light upon the controversial question, projected into prominence recently by the Engineers of L'Union des Gaz, as to whether Mr. Körting has captured anything in the way of material advantage by his advance from what is found at Dessau and in all other Continental cities and towns wherein the system has been established. It is true it is a question in which local circumstances must to an extent come into play; but appraising the relative results from Berlin and Dessau from (let this be emphasized) the British standpoint, it does not appear that, even in this last communication, Mr. Körting has made good a case of having really excelled Dessau in performance. We could wish now that he has reached the stage of comparing production, illuminating power, and calorific results with Dessau, that he would go a stage further, and give us a special article constituted of comparison step by step from ground space and capital costs, through coal used and labour employed, to gas (with illuminating power and calorific values) and residual results as between the 4-metre and the 5-metre retort. The information is all now so scattered, that concentration by such a clear writer and exponent of views as Mr. Körting would be of inestimable value. It is admitted that while here we are asking much of him, we have little as yet to offer him in return; but the debt will not be forgotten. He—as we do in this country who hope and believe that the vertical retort, supplemented by mechanical charging and discharging, has brought within reach continuous carbonization—recognizes that continuous carbonization has involved, to arrive at acceptable technical and commercial perfection, the traversing of a longer road and the surmounting of more difficulties than the simple plan of the Dessau retort. But Mr. Körting, throughout the controversy, has been chivalrous as a critic and defender of the intermittent method of vertical retort working; and in this last contribution of his we find the same spirit and the same candour.

A few words (before examining some of Mr. Körting's data as to results) on this question of evolution in carbonization, as illustrated by the Berlin working, which, of course, cannot be taken by gas engineers as a criterion for all judgment, although valuable as giving results based upon the operation of the systems under like conditions. What, then, has the evolution from direct-fired settings to the verticals realized on the basis of economical production, and under current conditions, in the Berlin works of the Imperial Continental Gas Association? With the generator horizontal settings, gas is produced at 3¼d. per 1000 cubic feet cheaper than by direct-fired retort-settings; the inclined retorts over the generator horizontal settings have realized a further economy of 1½d.; while the verticals have achieved an additional 3d. in economy. Add these items together, and the reward of greater scientific application is represented by about 8d. per 1000 cubic feet. But Mr. Körting bewails as discouraging the fact that the higher prices of coal and labour have swallowed up the economies. This is a matter that must be viewed over the tops of the walls marking our particular environment. Higher prices for coal and labour were inevitable; and the omens are that future normal prices for the former will be at a higher level than of yore, and with labour of late years there has always been progression, never recession, in the matter of remuneration. Under the circumstances, discouragement must not be permitted entry, but rather there is cause for the fullest gratification that our technical advances have enabled us to keep abreast of the additional burdens. Had it been otherwise, the increased costs would have crippled the industry; and its forward movement in the public service and commercially would not have been of the (in spite of active competition) persistent character of which we are to-day so proud. The statistical comparison which shows the evolution of the economies from every fresh completed advance in carbonizing method is of importance.

This brings us to the vertical retort system. The introductory sentence of Mr. Körting's last contribution is of exceeding interest: "At the Mariendorf Gas-Works, the "new vertical furnaces with 84 retorts [seven settings of "twelves], equal to about 1,225,000 cubic feet per day, "have been in action for some time." This is news supplementing that given in the Directors' report at the last meeting of the Imperial Continental Gas Association; but, in Mr. Körting's article, we do not trace that the data he advances as to result is from the working of these retorts, but from those at the Oberspree station. There is nothing said in the article about the eighth setting, containing five larger retorts, each capable of producing 42,000 cubic feet of gas per day, the results from which we shall anticipate with great interest. Mr. Körting lists again the advantages of the vertical retort as compared with other systems of working; and they cannot be too frequently repeated until they are well impressed upon memory. He submits that some of the aqueous vapours formed by the distillation of coal are converted into water gas, and so add to the output of gas, and that the collateral drawbacks of high heats have departed with the verticals. There is no formation of pitch, no naphthalene, and the quality of the tar is improved, and there is more of it. The quantity of ammonia recovered is greater; and the bisulphide of carbon is reduced by more than 50 per cent. The coke is harder, and contains less breeze. There is great economy of labour; and, under Berlin conditions, the structural costs are lower than for inclined retorts. That is a formidable catalogue of superior points; and yet they do not include anything as to the yield of gas, about which there is something to be said. First, however, we must stay to briefly refer to the items of the improvement in the intrinsic and the monetary values of the tar and coke. More tar and of better quality is obtained from the verticals than from the inclined or generator horizontal settings; but it can only be better quality that enables Mr. Körting to say that 25s. per ton is obtained for it as compared with 20s. for the tar from inclined retorts. The prices received for coke, too, and some remarks in the text of the article, have a conjunctive interest. The coke is harder and more compact than the ordinary; and therefore, for industrial purposes, it should be of greater market value. But up to the present it only realizes in Berlin 6d. per ton more (18s. 6d., against 18s.). A very hard coke is not the best for domestic purposes; but as for broken coke there is not a large market in Berlin, it may be assumed that the demand for domestic purposes is not a considerable one. That there is not a wider price between the two varieties of coke—ordinary and hard—may therefore be due to the fact that industrial demand has a big supply to draw from; but the additional hardness and density of the vertical retort coke should alone give it a higher value for manufacturing purposes. This consideration as to its superior intrinsic value for manufacturing purposes would lead to the expectation that the fuel account for the vertical settings would be lower than for the inclined retorts; but, as a matter of fact, it is found in Table I. to correspond to the 14 per cent. of coal carbonized of the generator horizontal settings as compared with the

12 per cent. of the inclined settings. The sole and simple explanation, we take it, is that the fuel includes the production of water gas on the vertical settings, of which production the inclined retorts are relieved. Before leaving the question of coke, the low make of breeze with the verticals is a point of advantage—1·5 per cent. on the coal carbonized, part of which is utilized to form beds in the bottoms of the verticals, and thus becomes agglomerated by descending tar and slow carbonization.

The gas produced from the verticals and the illuminating power are all-important matters to us in this country. Without beating about the bush, we would submit that Mr. Körting's higher yields of gas per ton of coal used cannot be attributed to the extra metre length of his retorts (whatever the addition may produce in benefit so far as labour is concerned), but are entirely due to freedom from a minimum illuminating power limitation, which allows the use of steam to an extent not permissible at Dessau; and it is because of this that we should like to have a detailed up-to-date comparison of the 4 and 5 metre settings, to see exactly where the justification for the 5-metre retort on the Dessau system is to be found. If we take the figures given in the introductory lines of the article, we calculate that the Mariendorf 5-metre retorts are each equal to a daily production of 14,583 cubic feet; the figures for the Oberspree retorts in Table VI. show a productive capacity of 14,974 cubic feet per retort per day (a difference of 500 cubic feet); and those for the 4-metre retorts at Dessau of 14,056 cubic feet. Consider the last two figures, and it is seen that the production per metre length of the 5-metre retorts is only 2995 cubic feet, compared with 3514 cubic feet for the 4-metre length. Turn now to Table I., and it is seen that the coal gas produced in the generator horizontal retorts is 320 cubic metres per ton of coal; and that only the same quantity of coal gas—nothing better—is produced in the 5-metre vertical retorts. If one requires a high production, says Mr. Körting in another part of this same article, a good deal of steaming is necessary; and to that—that illuminating power depreciating factor—and not to the increased metre length of vertical retort, is due the higher production of gas per ton of coal than at Dessau (though not per metre length) in the 5-metre retorts. And from our British compulsory illuminating standard point of view (the criticism of which by Mr. Körting we can endorse) what a gas that high make is! though the calorific power is right enough. It is a 10·80-candle gas tested by the Carpenter burner, as against (according to Table VI.) 17·70 for the Dessau gas. Mr. Körting remarks that it is certain the fifth metre of additional length is to a "slight" extent detrimental to illuminating power. We know that there is no mathematical proportion in the value attached by individuals to qualifying terms. But a drop between Oberspree and Dessau of 6·90 candles, and of 7·56 candles compared with the figure in Table VII., we, at all events, cannot conscientiously describe as being "slight." [Seeing that all the other figures for Dessau in Table VI. are the same as in Table VII., is not the 18·36 candles a mistake in the former?] We have no information as to the coal that was used in Berlin in October last from which the above figures were produced; but taking them in their nakedness, and comparing them with the Woodall-Duckham results, we much prefer, for the compulsory British conditions (which the home industry cannot help), those quoted recently from the Bourne Valley (Bournemouth) working, of 13,021 cubic feet of 14·20-candle gas, or the 12,633 cubic feet of 15·82 candles quoted by us on Nov. 12 for the Nine Elms settings.

Local Authority Gas Legislation Proposals.

THERE are nine Gas Bills being promoted by Local Authorities in which there are sections relating to gas; but there are not in them a similar number of points to which special consideration need be given. The Bills are not, however, by any means barren of interest—in fact, there are features of novelty about certain of the propositions upon which a watchful eye will be kept for the result. In most cases, these particular features are unobjectionable; in one, there is the gravest objection to any precedent such as is contemplated being created. We will deal with the exception first. It is a clause in the Keighley Corporation Bill; and it provides for any deficiency on one or more of the trading undertakings—water, gas, electricity, and tramways—being made up from profits derived from the others. The accounts of both the Electricity and Tramways Departments to June last had balances on the wrong side. But we care not which (if any) of the municipal undertakings are productive and which are unproductive, there exists all the same the gravest possible reasons against any such provision as that proposed by the Keighley Corporation being endorsed by Parliament. The finances of some municipal bodies are now in a sufficiently chaotic condition without giving legislative sanction to any confluence of the streams of profits and deficiencies from entirely distinct sources of trading adventure, and thus further to blind the eyes of ratepayers to the real financial status of each concern. To our mind, there is an immorality about charging one class of consumers or patrons of a municipal undertaking with the losses created by a totally different service to another section of the ratepayers. We can quite see that a power such as that suggested in the hands of some municipalities would result in the prices to customers or users of a successful undertaking being set at such rates as might be estimated to produce a sufficient profit to recoup losses incurred by other concerns. The water, electricity, and tramways undertakings might all create losses, and the gas consumer be made the pack-horse for the whole. That is the possibility, and there ought to be protection against it. It is but reasonable to claim that, if the patronage of one section of ratepayers makes a concern successful, then the patrons should derive benefit from the prosperity they create by a reduction of the prices they are called upon to pay. The old principle that "every tub should stand upon "its own bottom" is as sound to-day as it ever has been; and it is to be hoped that Parliament will decline to endorse the proposition that speculative and uncommercial management shall be propped up by the proceeds of trading wisely and successfully ordered.

In another Bill—that of the Blackburn Corporation—we find a development of a righteous and time-honoured power in connection with gas supply. Most gas undertakings have the right to refuse to give, or to continue to give, a supply of gas to any consumer in arrear with his payments for gas supplied to any property tenanted by him, or for any premises that may have been previously occupied by him, within the area of supply. The Blackburn Corporation supply both gas and electricity; and they ask for the right to decline to give a supply of either commodity to any person who is in arrear with his payments for either one or the other; or if both gas and electricity are supplied to the same person they ask for the right to discontinue both services, if they deem fit so to do, on the payments for one or the other or both becoming in arrear. Proposals such as these are, as a rule, the outcome of experience. It can well be imagined that a sharper in arrear with the discharge of his accounts for (say) a gas service would endeavour, and perhaps successfully for a time, to satisfy his lighting requirements by applying for a supply of electricity. In fact, many are the circumstances that one can conjure up where such a power as that sought will be useful. It is a large extension of power; but the interests of the gas and electricity concerns will prevent it being used except with great discretion.

Protection against unprofitable prepayment consumers is being sought by the Padiham District Council. It is unfair to the profitable prepayment consumers that, under the system, there should be any unprofitable ones. But it is a contingency of the system; and we are not altogether sure that an alteration of the present conditions in the manner proposed by the Padiham Council will not add a complication to the system which will in the long run operate prejudicially. At the same time, there is justice underlying the power they are asking for. The proposal is that, in the event of the consumption of a prepayment consumer not reaching 3000 cubic feet, the Council shall have the right to demand, and take from, the consumer an additional payment at the rate of 2s. a quarter. Suppose an installation costing (say) £9, an excess payment on 3000 cubic feet per quarter of 10d. per 1000 feet would only amount to 10s. in the year, while 10 per cent. on £9 represents 18s.; which would be made up by the extra charge of 2s. a quarter. In putting the minimum consumption at 3000 cubic feet, the Council are not dealing harshly with the consumers; but, we repeat, whether the proposition is altogether a wise one in the cause of popularity is open to question. However, if the charge is made at all, it is one which should carry with it an obligation on the part of the Council to apply it generally under (as with discounts) "like circumstances, so "that there shall not be complaint of inequality or prefer-"ential treatment."

There are two Purchase Bills in this group—Tenterden

and Wath-upon-Dearne. In the former case, there is a compulsory acquisition in view; but the Company is a non-statutory one. They have a Provisional Order before the Board of Trade this session; so that they are not entertaining any sacrifice of their position. In the Wath-upon-Dearne case, the undertaking is being acquired by agreement. Leicester, Padiham, and Wath-upon-Dearne are asking for the Metropolitan No. 2 burner and the Harcourt 10-candle pentane standard for illuminating power testing. Authority to establish accidents funds is being requested by the Leicester and Burnley Corporations. The latter Corporation, too, are asking to have conferred upon them greater supervisory powers over the sale of coke by local vendors, in order that assurance may be given to householders that they receive what they pay for. The details of the Corporation proposals in this respect are set out in the abstract notice of the Bill in this issue. From what has been said, it will be agreed that the local authority Gas Bills are not without interesting feature.

An Unnecessary Proposal.

WHAT with the exhaustive inquiry into the powers of charge of the Metropolitan Gas Companies, the inquiry by the Departmental Committee of the Board of Trade, and several investigations by Select Committees of the two Houses of Parliament, all during comparatively recent years, we might surely be suffered a period of freedom from further official inquisition into London Gas Affairs. The result of those inquiries was to settle matters on a fairly clear and satisfactory basis. But there are Metropolitan local authorities who think the Gaslight and Coke Company big enough to serve as a perennial subject to satisfy their proclivity for meddling with and overhauling other people's business. The Finsbury Borough Council—not satified with the pile of blue books and minutes of proceedings before Committees that are available to them if they so desire—have lately proposed that the administration of the Gaslight and Coke Company shall undergo another official investigation, and have invited the co-operation of the other Metropolitan boroughs. The Bethnal Green Council concur with the views of Finsbury, and have accordingly made representations to the Board of Trade. The Shoreditch Council have now followed suit. But the Paddington Council are showing a little inquisitiveness as to the character of the case that the Finsbury Council would be able to set up against the Company; and they want details as to the statement that it is contemplated to present to the Board of Trade. There is caution in the action of Paddington. But the City of Westminster and no less than nine boroughs—Chelsea, Hammersmith, Hampstead, Holborn, St. Marylebone, St. Pancras, Stepney, Stoke Newington, and Woolwich—have decided to let well alone. This will not be encouraging to the militant spirits on the Finsbury, Bethnal Green, and Shoreditch Councils. The authorities on the negative side of the proposal possibly see, with us, that the present is a most inopportune time to be asking for inquiry into the affairs of the Company. The concern has been in recent times going through, in a sense, a stage of transition; and right commendably are the Board and the officials bringing the Company's affairs round to a wholesome condition. It was the re-establishing no doubt of gas-meter rents that stirred up to activity once more this little minority of North London authorities; but the reduction of 1d. in the price of gas has taken the wind out of their sails. It is a pity the Gaslight and Coke Company and a few other large ratepayers do not agitate for a thorough official inquiry into the working—financial and otherwise—of certain of the municipal electricity undertakings of the Metropolis. The issue might be more to the common weal than the present proposal. We should strongly counsel the local authorities, before pressing for further gas inquiries, to see that their own houses are in proper and irreproachable order.

A Column of Nonsense.

WHEN the daily journalist dips his pen into technical matters, we expect to be offended by grievous errors; but rarely do we remember having read such crass nonsense as filled a column headed "Pots and the Woman," in last Tuesday's "Daily News," which appeared under the name of Mr. L. G. Chiozza Money, M.P. for North Paddington. He started by quoting a not very brilliant passage from Mr. H. G. Wells's "Anticipations," in which the latter wrote: "Cooking might very easily be made a pleasant amusement for "intelligent invalid ladies," given "a neat little range, heated "by electricity and provided with thermometers, with absolutely controllable temperatures and proper heat screens." Mr. Money proceeded to state that "the majority of British "women are household slaves, broken on the wheel of unnecessary toil" for whom "life is a monotonous round of "ceaseless drudgery in a little ugly, ill-contrived, and uneconomic house." So far we have but little to complain of in the article, though we think the picture much overdrawn. But then comes his remedy—"Scientific pots"—otherwise, electrical cooking apparatus. "The first equipment of the "social reformer should be science," says Mr. Money; and we would add, of the journalist, accurate knowledge. We warmly commend to this fluent politician his own statement in the same nonsensical column, which, referring to the "model dwelling," says—"the result of talk without knowledge is seen to be a silly box of bricks;" though if this description of the modern working-class dwelling be a just one (which we do not admit), it reflects little credit upon the results of the policy of this Liberal member's Progressive friends on the London County Council, who have spent such vast sums on housing. Apparently all this while "the "scientist sits chafing, hungering for the chance to give the "London area a cheaper electricity. And for want of that "cheaper electricity, millions of women are to-day, and "every day, spoiling their husbands' dinners." Was there ever such silly balderdash written as this? Then follows a list of electrical appliances which "even now exist at moderate prices." Was ever such misleading phraseology? "And above all there is an oven which bakes perfectly, "because you have not to introduce air to burn coal gas, "and because you have absolute control of temperature." Was ever such "unscientific" twaddle, or such meaningless irrelevancy?

Following upon these absurd assertions, our Paddington politician proceeds to expound the methods by which his cheap electric paradise for working women can be reached. "Lay down the price of a few Dreadnoughts, and within "a few years every woman of moderate means would have "relatively cheap electric power at her disposal." This is so easy to say and so difficult to explain the meaning of, and still more difficult to carry into execution. Is it a proposal to have Imperial electric current brought into our kitchens at the expense of the State? Or is it a proposed subsidy to existing electric companies? Or what is it? We should have thought that the results of recent Electricity Bills in Parliament, and of recent electoral campaigns, would have been a warning against any further coquetting with unpractical Socialism. The other equally clear, sensible, and practical proposal of Mr. Money's is that "a wise Govern-"ment . . . would establish richly endowed experimental laboratories" to advance domestic economy. We can only refer this Liberal politician to his Liberal Chancellor of the Exchequer, who, after finding a few millions sterling to pay old-age pensions, will, no doubt, be quite ready to "lay down" a few millions more to purchase electric pots and pans for the populace!

Really, a truce to all this political and economic insanity, and enough of journalistic absurdity. Let Mr. Money come down for just a moment to sober facts in a sober world. Let him look at the history of the attempts at cooking by electricity, and then judge of the future by the past. Let him go into the hundreds of thousands of working-class homes and hear the high testimony paid to the convenience, cleanliness, comfort, and cheapness of cooking by gas. Let him learn what the gas companies all over the country are doing in this way for the poor. And let him humbly learn from the gas engineer something of the rudiments of the scientific consumption of gas. With this acquired knowledge and light, then let him take up his pen and write a column of sense.

Company Promoting and Capital Raising.

Mr. H. Warwick Gyde (known also by other names), undischarged bankrupt, company promoter, stock and share broker, and preyer generally upon the public, has been passing through the Bankruptcy Court; and the Official Receiver has issued his report which, with pleasure for one reason and disgust for another, we publish elsewhere in this issue. Mr. Gyde has a record which he does not share alone. His has been a life that has been variegated, and has produced much wretched result in rotten concerns, most (if not all) of which seem to have been liquidated, or are now going through that process; and his dupes are the

poorer for his operations. Two of the gas promotions in which he was specially interested were the West Suburban and the Kent County Companies. The week has also brought another application for money from the public. The East Sussex Gaslight, Coke, and Water Company, Limited, is the name of the concern applying; and our readers are strongly advised not to have anything to do with the subscription of capital or with counselling anyone else to drop his money. This little concern, which was only started some three years ago, has, we gather, already raised preference and ordinary capital to the amount of £12,885, and £10,000 in debentures. The present attempt of the Directors to raise more money is limited to £6000—that is to say, to the issue of 600 6 per cent. £5 preference shares and a similar number of £5 ordinary shares. The prospectus has been very widely circulated, so that the Directors (certain of whose names have appeared somewhat frequently in connection with latter-day promotions) are anxious to secure money quickly. So anxious are they that on this issue they offer the bait of "a quarter's interest at the rate of 5 per cent. per annum up to Dec. 31 last," and payable on Feb. 1 next. If that is not sufficient to raise suspicion as to the character of the concern, we do not know what is. Of course, according to the prospectus, the report of the Engineer (Mr. F. G. Vivian), and so on, the prospects of the Company are most encouraging; but there is a poverty of positive information as to the works possessed by the Company, and as to the unprofitable nature of the undertaking for those who have already put money into it. But there is more information as to what other Sussex Companies are doing. The old game! The water supplied by the Company is reported by the County Analyst to be "very soft;" we hope there will not be many members of the public to whom the same description could be applied as the result of the issue of this prospectus. What is said as to the agreements with the Gas and Water Supplies and Construction Company, Limited (useful concern that it is for the promoters of this class of Company), and with the Ticehurst Gas and Water Company. is, in our opinion, quite sufficient for the recipient of this prospectus to promptly consign it to the nearest fire.

Dealing with Gasholder Tank Water.

After six months, the proceedings in the nuisance case in which the South Suburban Gas Company are concerned were resumed last Thursday. Allegations were made that, simultaneously with gasholder extensions at the Company's works, nauseating smells spread over the district; and the evidence given on the part of the Borough Council and the residents complaining appeared to point to the removal of the tank water as the cause of the nuisance. The Company's witnesses, on the other hand, were of opinion that a congested state of the Lower Sydenham sewers was the cause of the trouble. The time that has elapsed since the last hearing has been spent by the parties in further inquiry; but, owing to the illness of a witness, the whole result of that inquiry is not yet public property. The matter being still *sub judice*, no comment can be made; but it may be pointed out that the interesting part of the proceedings last Thursday were the suggestions made by Mr. W. J. Atkinson Butterfield for dealing, when gasholders are undergoing extension, with the water that has been used in the holder tanks for some years—his contention being that the manufacture of carburetted water gas has produced a change in the condition of tank water (and not for the better when it comes to the day for emptying), and that fresh procedure should be adopted when removing it. The answer of the Gas Company will be a further interesting phase of an unusually interesting case.

Municipal Coal out of Favour.

Like a good many other subjects, the question of the purchase of collieries by municipalities crops up at fairly regular intervals, though the progress made towards putting the idea in practice is anything but commensurate with the frequency of the discussions upon it. Even its supporters, it seems, have no very great faith in the early addition of this new department to the already long list of businesses which have been taken in hand by different local authorities—at least, this is a reasonable conclusion to arrive at from a discussion which took place in the Warrington Town Council a few days ago. The resolution before the meeting, after affirming that it would be "in the interests of the community for municipal corporations to be able to undertake the supply of coal," set forth that the Town Clerk should be instructed "to circularize each town and city council in Great Britain, asking them to pass a similar resolution, and forward a copy of the same to the Association of Municipal Corporations, with a request that the Association should urge the Government to pass legislation giving powers to municipal corporations to undertake the sale of coal, and the purchase of coal mines." This suggestion is of somewhat wider scope than those that have hitherto generally been submitted on the subject; and it did not commend itself to the Warrington councillors—no less than thirteen of whom declined to vote upon it, while eleven opposed it, and only six expressed themselves in favour of the suggestion. On one point, there was probably unanimous agreement—and this is that, however desirable some step may appear to be theoretically, the present time, with coal at abnormally high prices, cannot be a favourable one for the purchase of the collieries which would be required for the purpose. Admitting then that the time is not opportune, it is very doubtful whether the Association of Municipal Corporations would have felt inclined to make any move in the matter even had the resolution been passed by the Warrington Town Council. The proposer was a Socialist; but he asked his fellow-members for the time being to forget this fact, and discuss the motion from a business point of view. Why forget that he was a Socialist? Is it possible that he himself thought Socialism is not compatible with regarding matters from a business point of view? However this may be, his line of argument was, If it is right for the Corporation to purchase thousands of tons of coal per year and sell it to the people in the form of gas, why should they not buy thousands of tons more and sell it to citizens as fuel? Domestic consumers are now, he said, paying for their coal 5s. a ton more than the Corporation; and he calculated that this extra sum amounted to £18,250 a year, or equal to a rate of 1s. 7d. in the pound. Another point—less likely to carry weight—which was urged was that the continual growth of municipal expenditure made it imperative that they should seek new sources of revenue. If it is true, as declared by the speaker, that municipal enterprise has "scarcely yet begun," it will doubtless be necessary to tap fresh "sources of revenue." But pending convincing proof of the necessity for further "enterprise," might it not be more useful to try and keep the expenditure within the bounds of such revenue as is already available without seeking additions by embarking upon so speculative a business as that of coal-owners? The Corporation of Warrington enjoy a monopoly in the distribution of gas throughout the town; but it is not clear whether they would seek to make a similar monopoly of the sale of coal.

The Franco-British Exhibition.

It seems that the electrical industry have at length made up their minds what they will do at the Franco-British Exhibition. There is to be a co-operative exhibit between the London Electricity Supply Companies and the manufacturers. A large general stand, and a small staff of impartial demonstrators, with a free supply of electrical current and other facilities, are the outlines of the plans. The arrangements for the Manchester Electrical Exhibition, however, continue to practically monopolize attention in the electrical industry; and the Franco-British Exhibition is being treated as quite a secondary affair. Meanwhile, the Committee for the Gas Section at the latter are pushing forward their scheme for a joint demonstration by gas companies of the uses of gas; and the lines they are taking will prove popular among the wanderers from the Stadium to the opposite parts of the area at Shepherd's Bush, and to the side of the Engineering Section on which the display will be located.

The Gaslight and Coke Company and their Working Results for July-December, 1907.

The accounts of the Gaslight and Coke Company for the past half-year (we learn from Mr. H. Rayner, the Secretary) show that—subject to audit—the balance to the credit of the net revenue account will enable the Directors to recommend the payment of a dividend at the rate of £4 8s. per cent. per annum, carrying forward a balance to the next account of £349,551.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 193.)

THE Stock Exchange has had what may be called a disappointing week. It opened quiet and sluggish on the eve of the fortnightly settlement, but received a cheering fillip when the German and Belgian banks lowered their rates. Confidently anticipating an active demand, most of the leading departments hardened in price. This tendency was fortified on Tuesday, though business was not brisk; and Consols had a further rise. All the gilt-edged class were firm, and even Americans had a smart recovery. But Wednesday was a little doubtful; the confident anticipations appeared to have died away, and movements were far from being uniformly favourable. On Thursday, there was no mistake about it. Professional operators were setting their houses in order and closing down commitments. Flatness ruled generally; and the lower Bank rate, having been fully discounted, had no effect as a stay. Realization was still in full swing on Friday, with the natural result. Lower prices everywhere prevailed, though some of the gilt-edged division were not great sufferers. Saturday had to contend with the same depressing influences; but again, for special reasons, the choicest lines were exempt from the weakness. In the Money Market, there was a very fair demand for the Stock Exchange settlement, which was met at light rates; and discount terms steadily relaxed. The Bank of England on Thursday reduced the official rate to 5 per cent. from the 6 per cent. rate which had lasted just a fortnight. Business in the Gas Market was very bright and active; and movements in value were all in the upward direction, though they could not be expected to be as numerous as the week before. In Gaslight and Coke, the ordinary was abnormally active and firm. Barring one special bargain at 97, all transactions were within the limits of 97½ and 98½, with a tendency to go even higher. The secured issues were quiet; the maximum changing hands at 86¾ to 87½; the preference at from 104 to 105; and the debenture at from 81¾ to 82¼. South Metropolitan was quiet and strong at 125 to 126—a rise of 1. The debenture made 81½ *ex div.* Both Commercials rose a point, but were very quiet. The 3½ per cent. was done at 103½ and 105; and the debenture at 80½. In the Suburban and Provincial group, Alliance new was marked at 14⅜ (a rise of 1), Brentford old at 245 and 249, Brighton ordinary at 154, and South Suburban at 118½ and 119 (a rise of 1). The Continental Companies were little dealt in. Imperial had a further advance of 3, with transactions ranging from 177½ to 180, Union was done at 107, and European fully-paid at 22¾. Cagliari was done at 26½ and 26¼. Among the undertakings of the remoter world, River Plate was again largely dealt in; prices ranging from 13⅜ to 13 3/16—a rise of ¼. Buenos Ayres changed hands at 11¼ to 11⅜, over Cape Town debentures at 50, Primitiva at 6 1/16 and 6 3/16, ditto preference at 4⅞ and 5 1/16, ditto debenture 94, San Paulo at 13¼ and 13⅜, and ditto debenture at 47.

ELECTRIC LIGHTING MEMORANDA.

A Few Notes on Parliamentary Matters—Lighting of Westminster Abbey—Absurdities—Costs and Comparisons—Arithmetrical Exercises for Householders.

METROPOLITAN local authorities are not generally looking with favour upon the London and District Electric Supply Bill, because the Company that it is proposed to create are suggesting entering into direct competition with existing authorities for power supply. We do not see how such a Company could survive in London without they did so. The Company, however, put themselves under an obligation not to supply electrical power in an existing authority's area without their consent; but there is an innocent looking provision attached, which may in its effect mean much to the existing distributors. This provision proposes to make the existing distributors arrange their prices for power at whatever level the Company choose to name—the right on the part of the Company to supply being subject to the authorized distributors being willing to give a sufficient supply of energy at a price at which the Company are supplying it, or are willing to supply it. As Mr. S. W. Baynes, the Borough Electrical Engineer of St. Pancras, says, under this clause, the Company would be in direct competition for all the Council's power consumers, and might easily bring the price down to an impossible figure, obtain the Council's power load, and the lighting of the power consumers, through the 20 per cent. allowance made for illumination purposes. But why trouble? Local authorities do not seem to mind what price they get for power supply so long as they get the business. Among other projected parliamentary business of general interest is a scheme that the Great Eastern Railway Company have snugly ensconced in their General Powers Bill. They want to be clothed with power to supply electricity either in bulk or otherwise throughout their system. The local authorities along the line who have electricity supply powers are naturally very much agitated over the matter; but the Great Eastern Railway Company do not forget the municipal tramway competition, the rates they pay, and other incidents of recent years. The Lowestoft Town Council are among the applicants for an Electric Lighting Provisional Order; and this Council like others do not care to be put into a strait-jacket to ensure that the electrical business is conducted by them on sound financial lines. It is really singular how objectionable is compulsory honesty. The Lowestoft Water and Gas Company are suggesting the insertion in the Order of the Northumberland clause, or something akin to it—viz., that a notification as to a statement of accounts relating to the undertaking should be published; that after the fifth financial year the scales of prices charged should be so revised that, so far as is reasonably practicable, no rate will be required for the purpose of defraying the expenses of the proposed undertaking; and (*inter alia*) that there shall not be made against the district rate, or any other rate, for energy used by the undertakers for street lighting or any other purpose, a charge at a higher price than that charged to consumers using energy for similar purposes, and for the like hours of supply. The Council are resenting the intrusion of this large ratepaying Company, though they are doubly interested in ensuring that they are not called upon to support their competitor, after the competitor has been given a fair start. Among other applications for Provisional Orders is one by Messrs. Saunders and Co. for the lighting of Carmarthen. When the contract with the firm was originally entered into by the Council, the boasting of what would be done was loud and vain. Lighting was only to work out to the equivalent of incandescent gas lighting with gas at 3s. per 1000 cubic feet, and the Gas Company were to be brought with a rush to their proper bearings. The firm's draft Provisional Order is now before the Council. The picture as it develops appears to recede more and more from the original promise, until, if matters continue as they are going unchecked, the completed thing will be unrecognizable as the consummation of the promise.

Some ecclesiastical authorities prefer a dim, religious light in our sacred fanes, possibly being imbued with the idea that a depression of spirits is the proper condition to stir to emotion and to make impression. But we are of the other way of thinking. A dull building and a dull service are repellent to many, and drive them from public worship. Therefore, there is no ground on our part for complaining of Mr. Charles A. Baker in attacking in the pages of the "Electrical Review" the extremely bad lighting of Westminster Abbey; but there is disagreement with him as to the method of improvement. The transept, he says, is now lighted by nine standards, fitted with a total of 69 burners; and he suggests that each flat-flame burner used represents 4-candle power. His eyesight may be a little bit defective; but the rudest things said of flat-flame burners completely answers our purpose of advancing the cause of incandescent gas lighting. Accepting, then, his measure of the candle-power of the flame arcs (pardon! this slip of the pen is often happening when flat-flames are intended), he finds there is an effective illumination of 276-candles over an area of (say) 5700 square feet. His specification for a "clean new building" is ½-candle power per square foot of area, because that illumination will "usually pass without severe criticism." To get it, he suggests that twenty electroliers, each fitted with six osram or tantalum lamps of about 30-candle power should be employed. But let it be pointed out to Mr. Baker that Westminster Abbey is not a clean, new building, and that wiring, electroliers, and osram or tantalum lamps cost money, and that the annual expenses of 120 osram or tantalum lamps are not light. A much simpler plan of improving the lighting is by the removal of the antiquated gas-burners, replacing them by 69 incandescents of a type giving, for the same gas consumption, about 80-candle power, and thus securing an aggregate illumination of 5520 candles, or just about 1 candle per square foot of area. There is something about this plan of improvement that strikes us as being at once remarkably simple, efficient, and cheap. There will by it be no risk of a congregation having to go home prematurely because of a collapse, or of a mysterious fire occurring, the origin of which declines to be traced. There is a national liking for the preservation of ancient historical edifices. The building does not seem to have been damaged much up to the present by the archaic style of lighting in use.

In giving lighting costs, of course all sorts of absurd low figures can be arrived at by undercharging for this and that. This has been pointed out in these columns lately when dealing with the herculean struggles, if commercially insensate, of electricians to get the costs for flame arcs down below the price of high-pressure gas lighting. We are therefore pleased to see that certain electrical engineers have the courage to ridicule the absurdities to which some people in the electrical field append their names, and thus publish the fact that they are what they are to all intelligent folk. Mr. A. J. Abraham, the Electrical Engineer to the Lanark County Council, has grown sick of the absurdities; and, if ridicule will kill, then the British Arc Lamp Company will take early steps to amend a circular they have lately brought out. In that circular the Company state that the cost of running their 4-ampere arc lamps, at 1½d. *per unit*, is only £2 16s. per 1000 hours, whereas high-pressure gas-lamps cost £4 6s. per 1000 hours. It is left to the reader (Mr. Abraham points out) to infer that at 4½d. per unit—the average price of lighting by electricity—these interesting lamps will cost only £8 8s. per 1000 hours, as against £4 6s. for high-pressure gaslighting. He also reminds the British Arc Lamp Company that certain famous German carbon filament 10-watt-per-candle-power-with-no-name lamps will, at 0·0002d. per unit, knock spots off inverted lamps using gas at 16s. per 1000 cubic feet. And we believe him.

Another absurdity. Reference was recently made to a letter published in the "Electrical Review" by Mr. Sydney F. Walker,

of Bath (*ante*, p. 84), in which he alluded to the "much greater" cost of electricity compared with gas. An anonymous correspondent of our contemporary—"Unconvinced"—writes to correct the error of Mr. Walker's ways. "Unconvinced" asserts that Mr. Walker when he compares the costs of the two illuminants should liken the cost of the ordinary electric incandescent lamp to the ordinary fishtail gas-burner, and not to the incandescent gas-burner. Why? The gas industry has discarded (if lagging consumers have not) the flat-flame burner as an efficient means of illumination. If, says this unwise counsellor, Mr. Walker is comparing the incandescent gas mantle with electricity, he must put it against the arc lamp. We were surprised to find the "Electrician" doing this the other week. If our electrical friends go on at this pace, they will positively make the incandescent mantle blush. Such encomiums are not expected from the competing quarter. Fancy a little incandescent mantle, and 3½ cubic feet of gas an hour, being put up as fit for comparison with an electric arc lamp! Why not put high-pressure incandescent gas-lamps from 300 up to 3000 candle power against high-power arc lamps; the self-intensifying gas-lamps against the lower power arc lamps; and leave the various descriptions of ordinary and inverted incandescent gas-burners for comparison with electric incandescents?

Yet another absurdity; and there have been a few that have emanated from the West Ham Electricity Department within its chequered career. A circular has been sent round to residents in roads where electric cables are being laid; and this is what is said, and said in very bad form: "As the supply of electricity is now *so much cheaper* than gas, apart from other numerous advantages—such as cleanliness, the doing away with unhealthy fumes and bad heat—I feel sure [this is the Engineer and Manager of the department writing] you will give the matter your immediate consideration." The householder will remark that it is "the supply" not "the use" of electricity that is asserted to be so much cheaper than gas; and it is a pity the word "numerous" could not be better justified. We have a suggestion to make about this cheapness directly; but as to the "unhealthy fumes," householders are wearying of the electrician backing his importunity with this old threadbare fable. As to the "bad" heat, it has been found rather comforting than otherwise in recent severely cold weather, when even electric radiators came out second-best in the tussle with the low temperature. The circular proceeds: "In an ordinary private house, the number of lights burning regularly will average about four or five 32-candle power lamps. If you wish to compare electricity with gas, take the number of hours each mantle burns, add these together, and divide by 11. This will give you your cost of electricity in pence on the assumption of a 32-candle power osram lamp in place of each gas mantle, which you will find ample." The disingenuous character of this statement is apparent on the surface. It suggests an equality in candle power between an ordinary incandescent gas-burner and a 32-candle osram lamp. It says nothing about the cost of installing the electricity; nothing about the initial costs and renewal of the osram lamps; nothing about the necessity for purchasing and using transformers where the voltage is too high for the lamps, or alternatively for running the lamps in series, and so bulking up to the old consumption of the best of the electric carbon filament lamps. And then the circular gives something worse than Limericks in the vaguest of all arithmetical exercises for the householder. Blandly says the Electrical Engineer and Manager, if you want to know the cost of electricity, add together the numbers of hours your gas mantles "burn" (by the way the mantles do not burn, the gas does), and divide by 11; and this will give the cost of electricity in pence. Where does the 11 come from? Why not divide by 100? The householder will be just as much entertained and convinced. But the Electrical Engineer and Manager knows full well that no gas consumer is likely to have kept count of the numbers of hours his incandescent gas-burners are in use in the course of a year; so that he feels on very safe ground. But we further read that, if the product of the sum is compared with the quarter's gas account, he is "sure" the householder will find there is a great saving in the lighting account. Estimates, vague calculations, and quarterly accounts are, however, different things. But the Engineer asserts there is a great saving. Very well. Let the householders of West Ham enter into a bargain with the Electrical Engineer for an illumination equal to that they can get from respectable types of incandescent gas-burners, and for the same liberal hours' use, at a "great saving" on their last year's gas accounts. He has got to justify his declaration; and he ought to do an excellent business in this way. As he is so "sure" of the saving, there should be no hesitation on his part about entering into such agreements with householders, among whom the bijou incandescent inverted gas-burner is spreading rapidly, giving a light of from 20 to 25 candles (according to the character of gas) for an expenditure of about 1 cubic foot an hour. Improvements in gas lighting have not come to a dead-stop.

The number of producer gas plants has recently been very greatly increased in Canada. According to the "Engineer," the city of Chatham, Ontario, is now erecting a municipal plant, to be equipped entirely with gas-engines and with an absolute guarantee that its street lighting plant shall cost only £5 per lamp per annum. Two years ago there were practically no gas-engines of high power in Canada.

GAS BILLS FOR 1908.

[Third Article.]

Coming to the Corporation measures, they are mostly of the "omnibus" type, and, except the Purchase Bills, contain but few points of general interest.

The Blackburn Corporation, in a Bill of many parts, seek to have their limits of gas supply extended, so as to include the township of Clayton-le-Dale in the rural district of Blackburn. The Corporation propose to take advantage of their position as suppliers of both gas and electricity, to see that persons in arrear with their payments for one service do not, on the supply being cut off, obtain a supply from the other service. The clauses to give effect to this proposal read—

> The Corporation may refuse to supply electrical energy and gas, or electrical energy or gas, to any person whose payments for the supply of electrical energy or gas, or for the hire of any meters used in connection with electrical energy or gas, are for the time being in arrear, whether any such payments be due to the Corporation in respect of a supply of electrical energy or gas, or for the hire of any such meters, used on the premises in respect of which such supply is demanded, or in respect of other premises.
>
> In any case where the Corporation supply both gas and electricity to the same person, and he fails to pay the rent charges and sums due from him in respect of either such supply, the Corporation shall have the same powers to cut off and stop both supplies as they would have with respect to the supply of gas if he neglected to pay the rent due for the same.

In the clause as to the period of error in defective meters, the Corporation have not taken advantage of the modern style of clause. The clause as it appears in the Bill contains these words "such erroneous registration shall be deemed to have first arisen during the then current quarter." The modern rendering is "shall be deemed to have arisen during the then last preceding quarter of the year, unless it be proved to have first arisen during the then current quarter." Provisions appear in the Bill authorizing, and stating the conditions of, a superannuation or provident fund for persons in the employ of the Corporation. [*Parliamentary Agents: Messrs. Tahourdins and Hitchcock.*]

A voluminous Bill is being promoted by the Burnley Corporation; but little more than a page suffices for the gas section. All the clauses are common in present-day Bills, excepting the special one which provides that, notwithstanding the provisions of section 158 of the Act of 1871, it shall be lawful for the Corporation to sell and supply gas in the township or parish of Cliviger as if that township or parish abutted upon the borough within the meaning of that section. In another section, headed "Markets and Sale of Coke," provision is made for the keeping of a register by the inspector of weights and measures of the names of coke sellers, for the names of coke sellers to be affixed to the vehicles they use, for coke to be carried in 1 cwt., ½ cwt., or ¼ cwt. sacks, every sack having a metal label affixed to the top indicating the correct weight of coke therein, and for the weighing of the coke if requested by the purchaser or by an inspector of weights or measures. The penalty attaching to the violation of these provisions is not to exceed £5. Clauses also appear for the Corporation establishing insurance and accident funds. The increase of reserve funds for the gas and water undertaking to one-tenth of the capital value is arranged for, and for the electricity undertaking to one-fifth. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

There is a gas and electricity section in the Keighley Corporation Bill; but there is nothing special about the clauses calling for notice. In the financial portion of the Bill, however, the following clause is found:

> If after payment of all expenses properly chargeable to revenue in any year, there is a profit upon the water, gas, electricity, or tramways undertakings of the Corporation, and if in the same year there is a deficiency upon any of such undertakings, the Corporation may, in lieu of making good such deficiency out of the fund or rate to which such deficiency is chargeable, apply the before-mentioned profit to making good such deficiency.

Reserve and renewals funds are provided for in respect of the four undertakings mentioned. [*Parliamentary Agents: Messrs. Sharpe, Parker, Pritchards, Barham, and Lawford.*]

Adjacent to the limits of gas supply of the Leicester Corporation are the townships and places of Markfield, Rothley, Swithland, Woodhouse Eaves, and Woodhouse; but they have no adequate supply of gas. The Corporation in their "Omnibus" Bill ask to be granted the necessary authority for giving a supply. Within the additional gas limits, provision is made for any Sanitary Authority, if they so desire, purchasing the portion of the gas-works and plant in their area upon giving six months' notice. With regard to the testing of gas, the Corporation are to come up to date by adopting the "Metropolitan" No. 2 burner and the Harcourt 10-candle pentane lamp. In this Bill, again, an employees' accidents fund and a fire insurance fund are both provided for. [*Parliamentary Agents: Messrs. Dyson and Co.*]

There is a solitary clause relating to gas in the "Omnibus" Bill of the Manchester Corporation. It provides that, "from and after the passing of this Act, the Acts of Parliament relating to the gas undertaking of the Stretford Gas Company shall cease to apply to, or be in force within, the township of Chorlton-cum-Hardy in the city." [*Parliamentary Agents: Messrs. Sharpe, Parker Pritchards, Barham, and Lawford.*]

In the Bill of the Padiham District Council, gas comes well to the front. The Council are asking that the limits of gas supply be extended so as to comprise the townships of Sabden Read and Simonstone, and part of Altham. They request that it may be enacted that the Accrington Gas and Water Board shall not supply gas within any part of the limits of the gas-supply area of the Council, and that their powers of supply in the part of Altham referred to above may be repealed. Provision is made for the purchase from the Parish Council of Read of their gas mains and pipes; the price to be fixed by agreement or by a single arbitrator. Additional lands are scheduled for new gas-works. Regarding prices for gas outside the Council district, they ask for the right to charge in Sabden not more than 1s. 3d. per 1000 cubic feet in excess of the ordinary charge, and 6d. excess in other parts of the limits of supply outside the Council area. The prepayment clause, so far as the 10d. for meter and fittings and 1s. if the fittings include a gas-cooker are concerned, is as usual. There is then this variation—

Where any consumer supplied with gas through a prepayment meter shall not in any quarter of a year consume at least 3000 cubic feet of gas, the Council may, in addition to the charges by sub-section 2 of this section authorized, demand and take from such consumer in respect of such quarter any sum not exceeding 2s. as and by way of an additional charge for the hire of such prepayment meter and the fittings of the Council (if any) used therewith.

The illuminating power of the gas is prescribed at 14 candles, tested by the "Metropolitan" No. 2 burner and Harcourt's 10-candle pentane lamp. The remaining clauses are of ordinary form. For the construction of new gas-works and the purchase of the pipes of the Parish Council of Read, the promoters request power to borrow £40,000, and for the purchase of cookers and meters and fitting them up, £5000. The periods of repayment requested are respectively thirty and ten years. Provision is also made for the redemption of gas and water annuities by agreement. The improvement of the gas-works and the building up of a reserve are arranged for from surplus profits, after satisfying the demands on the profits as provided in previous Acts. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Tenterden Corporation submit in the preamble of a Bill they are promoting that it is expedient the gas supply should be in their hands, and that the undertaking of the Tenterden Gas Company, Limited, should be transferred to, and vested in them. They propose that if the Act is passed, notice shall be given to the Company within three months of the intention of the Corporation to purchase the undertaking—the consideration for transfer to be agreed or determined by arbitration, "provided that, in determining the said price or consideration, no allowance shall be made for compulsory purchase." The Corporation are proposing also to pay the Company the actual reasonable and necessary costs and expenses incurred in winding-up "not exceeding in the whole the sum of fifty pounds." For the purpose of reducing the expenses of the arbitration, a clause appears providing for one arbitrator, one counsel apiece, and not more than two expert witnesses. The remaining provisions in the purchase section of the Bill are of common order in such measures. In the part of the Bill empowering the Corporation to supply gas, the maximum price to be charged is put at 4s. 8d. per 1000 cubic feet. The 10 and 15 per cent. discounts clauses is inserted. The illuminating power of the gas is proposed at 14 candles, tested by up-to-date methods. The Corporation ask power to borrow the sum of money required for the purchase of the concern, and for the extension and improvement of the works and for working capital. For the repayment of the purchase money, 45 years is desired, for the money spent on extensions and improvements thirty years, and for working capital ten years. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Wath-upon-Dearne District Council are contemplating the acquisition, by an agreement already entered into, of the undertaking of the local Limited Gas Company. The issued share capital of the Company is £35,000; and £7800 is still owing in respect of debentures. The purchase price arranged is £61,630, with interest up to the date of actual payment of the money, in respect of £11,250 as from June last at the rate of 4 per cent. per annum, and on £49,900 from Dec. 31, 1906, at the rate of £4 2s. 6d. per cent. per annum. The intention of the parties is that the preference "A" shareholders of the Company shall receive the £11,250 and the interest thereon, and the ordinary shareholders the £49,900 and the interest thereon, and that the balance of the purchase price, £480, shall be paid to the Secretary and Directors as compensation for loss of office. If desired by Mr. George Wright, the Company's Manager, the Council shall enter into an agreement with him to employ him as their Manager for a term of three years at a salary of not less than £210 per annum. All the necessary provisions are made for the transfer of the property, for the winding-up of the Company, and for the conduct of the business by the Council. The lands on which manufacture may be carried on are scheduled; and power to purchase not exceeding 10 acres by agreement is requested. The usual prepayment meter clause appears. The price of gas is limited to 4s. 2d. per 1000 cubic feet. The illuminating power of the gas is to be 14 candles, tested by the "Metropolitan" No. 2 burner and Harcourt's 10-candle pentane lamp. The Council ask for power to borrow for the purchase of the works £69,430; for the extension and improvement of the works, £3000; for working capital, £2000. The period proposed for repayment in respect of the two former purposes is fifty years, for the last purpose ten years. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

In the Widnes Corporation Bill are a number of ordinary clauses referring to gas supply; and, in addition, there is the clause that proposes to abrogate the provisions of the 1867 Act referring to the allocation of the gas-works profits. This is a subject upon which comment was made recently in our editorial columns. Since then the ratepayers, in public meeting, have refused to ratify this parttcular proposal. [*Parliamentary Agents: Messrs. Hargreaves, Crowthers, and Jordan.*]

THE GAS ENGINEER'S PRICE-BOOK.*

Of all forms of compilations of a technical nature, the compiling of a price-book is perhaps the most difficult. The reason, of course, is obvious. It has to deal, not with any hard-and-fast matter or rules, but with ever-differing conditions and ever-varying costs of material and labour. Collections of useful tables for engineers, mathematical formulæ of all kinds, and such like, are comparatively easy productions—being granted accuracy and industry; for they relate for the most part to well-established and unchanging calculations and considerations. Even in builders' price-books, where there are of necessity a lot of simple, regular, and more or less stable quantities to be measured up and priced out, the difficulties are not so great. But where, as in gas-works' construction and management, there are innumerable and ever-changing problems, such difficulties of costing and estimating are much increased. The price of one piece of constructional work is not necessarily, or even frequently, much or any sure guide to similar work at another time or place. No doubt there are many gas engineers who have for a long time kept valuable records as to the costs of various plants they have put up; but they have realized that, though useful to themselves—knowing of all the surrounding circumstances in each case—such records might be misleading and dangerous in other hands. So it comes about that though there are isolated statements of gas-works' costs, there has not hitherto, we believe, been any attempt at a general compilation for general use of a price-book for gas engineers.

Mr. Fred. C. Moon, in "The Gas Engineer's Price-Book" now before us, has made a very laudable attempt to produce a comprehensive price-book to assist those engaged in estimating the cost of gas apparatus when works of extension and construction are to be carried out. As he says in his introduction, he has for years been in the habit of recording particulars of the capacity and cost of plant, and has now tabulated his notes, the use of which will, in some instances, avoid the necessity of searching through trade catalogues and the like. It is a neatly got up, gilt-edged book of some 100 pages, measuring 8 by 5 inches, of pocket-book form, though we are afraid it may be just too big to get comfortably into some pockets. Had the size been, say, 7 by 4 inches, it could have been more coveniently carried about for reference.

The contents are arranged alphabetically, with a good number of cross references. "Blowers" and "Boilers" start the list, but nowhere do we find "Burners." The costs of public lamps are given, and perhaps it was thought that private burners did not come within the scope of the work; yet "Stoves" are quoted. We think, however, that their inclusion might have been useful. Coal and coke conveyors are rather fully dealt with; though here, again, there being so many varieties, it would be difficult to include all. Useful information is given under the heading "Electrical," which, in these days of electric motors for driving gas-retort stoking machinery, is likely to be of great service. Rotary and steam-jet exhausters are priced, but not reciprocating ones. We confess reluctantly to being a little disappointed in the treatment of retort-houses and their equipment; although we fully admit the great difficulties in the way. We should have liked to have seen some guide as to the cost of the principal classes of furnace-work; and further details of the distinct varieties of retort-stoking machinery, which we should have expected to find under that heading rather than under "Coal-Handling Plant." When a second edition is called for, no doubt fuller information will be able to be given as to vertical retorts. In that event, also, hydraulic and foul mains might be added, the meter and governor house costs divided, and other classifications enlarged or re-arranged.

As a first effort in the difficult direction of providing a useful and reliable gas engineer's price-book, we find this compilation a worthy and commendable endeavour. We feel sure that with the expansion it will undergo in course of time, if judiciously undertaken, the book will prove of permanent value as a work of reference. But we must also sound a note of warning. With the fluctuating prices of materials, the variety of engineers' designs, the variations in soil and foundations, and the differences in ideas and circumstances, any such price-book can, at the best, only be a rough and approximate guide. In ignorant hands, it might be the cause of gross errors. Wisely used, it should often be of real assistance. As Mr. Corbet Woodall says in his "Introductory Note" to the book (with which note we quite agree): "For difficult or unusual work, much and possibly painful experience can alone supply the necessary knowledge."

* "The Gas Engineer's Price-Book for Estimates and Valuations, with Notes on the Structural Capacity of Works and Plant." Compiled by Fred. C. Moon. London: John Allan and Co.; 1908.

ACCOUNTS OF WATER UNDERTAKINGS.

Messrs. Wood, Drew, and Co.'s Analysis.

THOSE of our readers who are connected with, or interested in, water undertakings are doubtless aware that since the first appearance, nearly thirty years ago, of the analysis of accounts now annually compiled by Messrs. Wood, Drew, and Co., several changes have been made in the publication with the view of rendering it more generally useful. At first confined to the accounts of the Metropolitan Water Companies, its scope was widened a few years ago by the inclusion of those of the Coporations of Edinburg, Glasgow, and Manchester; and more recently of those of some of the principal water undertakings in the Provinces. In the "Analysis" issued towards the close of 1906, there was further development of this section of the book by the addition of three new towns—Bury, Croydon, and Leeds; and, as the water supply of London had passed into the hands of the Metropolitan Water Board, the compilers included a statement in regard to the transfer of the undertakings, a specially interesting feature of which was a table showing the consideration paid and the interest charged thereon per million and per thousand gallons of water supplied. The statistics of supply then presented were for the twelve months ended Dec. 31, 1905, and March 31, 1906, uniform in arrangement with those of the twenty-five preceding years; but no figures could be furnished in relation to the accounts of the Board. The hope was, however, expressed that an analysis of them would be given in the next edition.

This hope, as will be seen from an announcement appearing elsewhere to-day, has now been realized; for, though some delay has necessarily occurred in its production, the "Analysis" for the year 1906-7 is now ready. Its form has been changed somewhat by the omission of the tables furnishing details of the supply of water in the Metropolitan area, as this matter is now fully dealt with in the annual reports of the Water Board; but an analysis of the accounts for each of the two years ended March 31, 1906 and 1907, is given in a form which can be compared with that of the provincial undertakings. In view of the fact that the Board's Charges Act comes into operation on the 1st of April next, a statement is presented in which the annual domestic charges authorized to be made by each of the late Water Companies are compared with those specified in the Act. This useful compilation occupies one page, so that the difference in the charges can be seen at a glance. Companion tables, showing the charges for water for domestic, trade, and public purposes in the Provinces, are given. With regard to the twenty-four provincial undertakings, the arrangement of the analytical figures is the same as in the preceding edition. Though the tables occupy only 18 quarto pages, the amount of labour involved in their preparation will, we think, be readily estimated, and its value appreciated, by every water engineer or manager who has had any experience at analyzing accounts. As already mentioned, the scope of the "Analysis" has been widened; and the latest edition of it fully sustains the reputation the work has deservedly gained.

OBITUARY.

The death occurred last Wednesday, at the age of 77, of Mr. ORCHARD J. WEEKS, who was for some time connected with the Nottingham Gas-Works. Deceased was a native of London, and went to Nottingham in 1856 as Superintendent of the distribution department of the Gas Company. When the Corporation acquired the undertaking in 1874, he went to Cambridge as Manager of the gas-works there; but in July, 1882, he returned to Nottingham on being appointed Superintendent of the Eastcroft station. A year later, however, he went back to Cambridge. On his retirement, he removed to Nottingham, where he resided until the last. Mr. Weeks joined the British Association of Gas Managers in 1881, and passed into the Gas Institute; but he severed his connection with that body in 1888. He was a Freemason of many years' standing, and was an active member of the Newstead Lodge (No. 47). At the funeral, which took place on Saturday, in the Nottingham Church Cemetery, the Gas Department of the Corporation as well as the Lodge were represented.

The recent death is announced of Mr. THOMAS FITCH ROWLAND, who may possibly have been personally known to those of our readers who have visited the United States. He was a native of New Haven (Conn.), and in early life was engaged on railway work and shipbuilding; but later he took up the design and construction of gas manufacturing plant. Conspicuous among his productions in this branch of engineering were the Commercial Point station of the Boston Gas Company and three stations of the Consolidated Gas Company in New York City. In 1887, his business was incorporated as the Continental Iron-Works, at Brooklyn, and he was its President up to the time of his death. Soon after the Company commenced operations, he designed and constructed a gasholder and steel tank for the Fourteenth Street Station of the Consolidated Company; and it was then regarded as a notable achievement in gas engineering, being the largest of its kind in America. Mr. Rowland was a member of various engineering societies and other bodies. He was a widower (Mrs. Rowland having died in 1902); and he is survived by two sons, Messrs. T. F. & C. B. Rowland. Deceased was in his 77th year.

PERSONAL.

Mr. H. RUSSELL, Assoc.M.I.Mech.E., late of the Abergavenny Gas-Works, has been appointed Manager of the gas-works at Ammanford, and will commence his duties on the 30th inst.

Mr. JOHN F. ROBERTSON, who has been employed in the Alloa Corporation Gas-Works for the past ten years (for the last two of which he has held the post of foreman), has been appointed Manager of the Polmont Gas Company.

Mr. THOMAS CORRIGAN, who has been some years Manager of the Milnthorpe Gas-Works, has been appointed Manager of the gas-works at Crediton. His place at Milnthorpe has been taken by Mr. JESSE HALLIWELL, of the Bolton Gas-Works.

At a meeting of the Directors of the Rhymney and Aber Valleys Gas and Water Company on the 10th inst., Mr. ARNOLD W. BRANSON was appointed (in addition to his present duties as Engineer and Manager) Secretary to the Company, in place of Colonel A. P. James, who has gone on to the Board.

A marriage of interest in French gas circles is to take place in Paris on Thursday next at the Eglise de la Trinité. It is between M. JULES VERDIER, one of the Engineers of the Société du Gaz, of Paris, and Mademoiselle MARGUERITE PAYET, a relation of M. Joseph Payet, the Secretary of the Société Technique de l'Industrie du Gaz. M. Verdier was formerly Engineer at the Marseilles Gas-Works, and afterwards at the Genevilliers works in the suburbs of Paris, which he left to take his present position. His name has frequently occurred in our reports as the contributor of papers to the proceedings of the French Technical Society.

Mr. W. S. EASSON, son of Mr. D. Easson, the Manager of the Selkirk Gaslight Company, has been appointed Manager of the Jedburgh Gas Company, in succession to the late Mr. G. Taylor. Mr. Easson received his practical training under his father—first at Maybole and then at Selkirk. For some time he has held the position of Assistant Manager at Selkirk. He was a student in the Galashiels Technical Institute, and passed with honours the examinations in "Gas Manufacture" of the City and Guilds of London. He is also a member of the Eastern District of the Scottish Junior Gas Association. There were eighty-five applicants for the post.

The numerous professional and engineering friends of Mr. WALTER W. MARTIN, Chief Draughtsman at the Midland Iron-Works, Donnington, will hear with regret that, owing to failing health, his long period of service with Messrs. C. & W. Walker is about to terminate. It was in the late "sixties" that Mr. Martin was, as a youth, articled to the late Mr. W. T. Walker, at the London offices of the firm. He was soon transferred to their works at Donnington; and within a comparatively short time after the completion of his apprenticeship, he was placed in charge of the drawing offices at the works. This honourable and responsible position he has since continuously filled; and his full term of service has therefore extended to close upon 40 years. Mr. Martin's retirement will take effect at the end of the present month; and we understand that it is his intention shortly to carry into effect a long-cherished desire to proceed to New Zealand, where he has a large circle of relatives and friends, and where it is hoped that his health will be fully restored and that he may find a good field for the exercise of his wide and undoubted technical knowledge and experience. His friends will doubtless join us in wishing him all prosperity and renewed health in the new life he hopes now to enter upon.

The New Engineer-in-Chief at Milan.

With reference to the engagement of Mr. A. Clement Hovey, of North Shields, by the Directors of L'Union des Gaz, which was briefly noticed in the "JOURNAL" a fortnight ago, we learn that Mr. Hovey is to hold the position of Engineer-in-Chief of the several gas-works of the Company in Milan, and will superintend the whole technical service there. Mr. Hovey's engineering experience commenced in the constructional drawing office of Hadfield's Steel Foundry Company, Limited, at Sheffield; and he was for two years a pupil of Professor Ripper, the Principal of the Sheffield Technical College. In order to obtain a thorough training as an engineer, he entered the works of Messrs. John Abbot and Co., Limited, of Gateshead, as a pupil, and passed through their workshops and constructional department in a three years' course, afterwards entering their drawing office for three years and becoming leading draughtsman. In 1897, he was appointed Assistant Engineer and Manager of the Tynemouth Gas Company, North Shields. This position he has held ever since, and during his service has designed in full detail the whole of the Company's new works of 2½ million cubic feet daily capacity, which were put into operation in 1901, and are now being extended. The annual output of the works has nearly doubled since 1897. In the course of his experience, Mr. Hovey has designed other complete gas-works. He is Vice-President of the North of England Gas Managers' Association, and has read papers before the members on two occasions. In both papers he gave interesting particulars in regard to the constructional details and costs of the extensions at Tynemouth already referred to. He will take up his duties in Milan in the course of a few weeks.

WITH THE TOWN COUNCILLORS OF OLDHAM.

A Question of Policy, and a Visit to the Works.

It always appears to the writer that, under the most favourable circumstances, the management of a municipal trading undertaking by a Committee is beset by many disconcerting difficulties. The most irritating of these difficulties are not the ordinary associations of the technical and financial affairs of the department. These in themselves are sufficient to ruffle considerably the peace of mind of the members of a Committee who earnestly and intelligently devote themselves to the work with which they are entrusted; but in those matters they have the guidance of men whose lives and interests are centred, through training and vocation, upon such work, and who have no other main business to divert their attention. But the difficulties of position and of duty are accentuated by the criticism—sometimes poignant and caustic, though without reason or foundation—of fellow-members serving various constituencies and interests, some of them captiously inclined, some of them with "axes to grind," some (they have been met with in journeyings up and down the country) with "bees in their bonnets." Such men should consider that the members of the administrative committee of any municipal concern are actuated just as much by the best intentions to serve the community as are their critics. But one good method of silencing hypercriticism is an open and frank confidence, and the offering of opportunities for the uninitiated to get a sight into the "true inwardness of things." A municipal body is very like the shifting sands; there is ever and again change. And one of the best means of keeping the membership well acquainted with the importance and position of, and even the difficulties encompassing, the trading undertakings is to organize periodical inspections of the works by the whole body. The Oldham Corporation Gas Committee believe in this; and thus it came about that yesterday week the writer found himself at the Oldham Town Hall, among the town councillors and representatives of the out-townships within the area of gas supply, who were being received there by the Chairman of the Gas Committee (Alderman Thompson, J.P.), his colleagues, the General Manager, Mr. Arthur Andrew, and the Engineer (Mr. T. Duxbury). The Mayor (Alderman Dr. Gourlay) was unable to join the party so early in the day, but he did so later on. The object of the gathering was a visit of inspection to the two principal stations of the Gas Department.

General Position of the Oldham Undertaking.

The Town Hall was left at 1.30 sharp by special tram-cars—the first works to be visited being Higginshaw. On the journey, a handy little card, prepared by Mr. Andrew, and distributed by his Assistant (Mr. I. H. Massey), affords some general information about the works, and shows the importance of the undertaking the Gas Committee have under their charge. It is gathered from it that the manufacture of gas in Oldham for public lighting was commenced in 1827, under parliamentary powers granted to the Oldham Gaslight and Water-Works Company in 1825. At that period the price of gas was 10s. to 12s. 6d. per 1000 cubic feet. The works were acquired by the Corporation in 1853; and the tremendous progress the undertaking has made is shown by the statement that the number of meters in use now is 50,723, as compared with 2100 in 1854. The excess of assets over the liabilities of the undertaking on March 25 last was £359,288.

The area of supply is 16,157 acres, 11,428 of which are outside the municipal borough. The total productive capacity per 24 hours of all the works is 11 million cubic feet; and the maximum gas delivery in 24 hours from all the works is 8,634,000 cubic feet. The aggregate total gasholder storage is about 6,535,000 cubic feet. The quantity of gas made annually is 1413 million cubic feet, against 106 million in 1854. The capital value of the works is £590,133, against £69,155 in 1854. The price charged for gas at present varies from 1s. 9d. net to the largest consumers, to 2s. 2d. net to the smallest consumers. In 1854, the price was 5s. 2d. per 1000 cubic feet. The price of gas for public lighting in the out-townships is charged at 1s. 11d. per 1000 cubic feet.

The Price of Gas and Free Service.

Here a pause should be made; for there is something to be said about this price for gas. It is indisputable evidence of Oldham being particularly well served. Search is made in two directions to ascertain the cause of this reasonable price; and it is found that no mistake is made as to the directions selected. Glancing at the capital account, it is seen that the expenditure is at the low rate of £426 per million cubic feet of gas made, notwithstanding that much money has been spent in modernizing plant and method at the works, in order to produce the economy that, united to the low capital charges, has assisted in bringing the price of gas to the present, for the consumers, very acceptable level. The average price last year—1s. 9d. net to the largest consumers and 2s. 2d. to the smallest—was 1s. 11d. per 1000 cubic feet. Five years ago, the price of gas throughout the district was 2s. 3d. to 2s. 6d. But with competitors assailing in this industrial centre, to retain the custom of the big consumers, the difference in the rate, charged to them was widened to 5d. But at the same time, as the 1s. 9d. and 2s. 2d. disclose, the smallest consumers have also received a considerable slice from the good fortune of the department; and this, be it noted, is for gas of (the average of last year's tests) 18·73-candle power, tested by the "London" Argand No. 1 burner. But low as these prices are for such gas, are the Corporation doing for the gas consumers all that they might do? The question is advisedly asked. Never mind what others are doing. But let it be remembered that this is a great industrial district; industry is of the very life of the town, and throbs in its every fibre. Success of industry quickens the town's whole life; depression of industry dulls it. Every direct encouraging service to industry and its great army of workers should therefore be given by the Corporation as a duty; and the absolutely lowest price should be charged for gas. That absolutely lowest price is not being charged to-day, and the reason is clear.

No undertaking other than one municipally managed would do work for nothing. Ask the local leaders of industry on the Town Council whether it is not a good commercial rule to do no work for nothing in business (in private life is another matter), and, while selling the product at the lowest competitive price, to give none of it away. The Oldham councillors are men with business engrained in their very natures; and we can imagine they would look askance at their questioner, and wonder whether he was bereft of his senses to infer there might be two answers to the question. But what they would not do in connection with their own private business they sanction in the public business, and thus impose a burden on the gas undertaking. The cost of the gas used in the borough street-lamps and in the public departments is a tax upon the gas undertaking; and in view of the fact that the Electricity Department are paid for any electricity consumed for public purposes, the Corporation do not see any necessity for patronizing their Electricity Department to any considerable extent for street lighting. There is serious injustice in this free public gas supply to the many gas consumers who are not ratepayers within the municipal borough, to the gas consumers generally, and to the gas undertaking. The gas consumed for public purposes costs money; someone has to pay for it, and who but the consumers of gas? while those who patronize the electricity undertaking and oil do not pay a penny piece towards this consumption of gas. Yet town councillors are always talking of equality of taxation! We find, too, that (about this, however, there cannot be so much complaint) cookers are fixed free, and there is no meter hire; and no charges are made for cost and maintenance of consumers' meters—meters being bought by property owners in the first instance. If the Gas Department were paid for the gas used for public purposes, the supply and fixing of cookers, and everything else, the opinion may be ventured that they would be in a position to sell gas for all purposes at a flat-rate of 1s. 6d. per 1000 cubic feet. See what a benefit this would be in this centre of industry, and to its great working population. Would that the town councillors of Oldham could see these things in the same way that the writer does. What is the opaque something that interposes itself in their vision? May it be said without offence, that it is empty popularity; and empty popularity among an unthinking constituency is valued higher than the material benefits following in the train of cheap gas. Is there not someone on the Oldham Corporation who will take up this matter, agitate it with persistence until the gas undertaking is run to give the cheapest possible service to the town, and until it stands in the proud position of being in the very front rank of concerns giving cheap gas supplies? The gas consumers have it in their power to compel their representatives to take up this matter in their interests. Over the question there need be no further lingering here; but it must not be left without a word of approval for the arrangement that limits the amount carried from the gas profits to the rates, though nothing in these competitive days ought to be so carried. On the capital outlay, the Corporation are entitled to take from the profits 6 per cent., with which to meet interest and sinking fund, and what remains is transferred to the rates. If there is not complete freedom from the old fallacy that the rates deserve something from the profits of a really productive public undertaking, limitation is undeniably the next best thing.

On the Higginshaw Works.

A little digression has been made; but the opportunity could not be missed for calling attention to this matter of price. The Higginshaw works have been reached by the special trams; and under the guidance of Mr. Duxbury (assisted by the Works Manager, Mr. J. E. Dudley), the members inspected the plant, and had the various operations explained. The extensions at Oldham have been from time to time described in the "Journal;" and therefore the briefest general survey of the plant will suffice. The station was opened in 1871; and it has two sidings in connection with the Lancashire and Yorkshire Railway—two locomotives belonging to the department negotiating the traffic on the sidings. The productive capacity of the station is 5½ million cubic feet per twenty-four hours. The members were first piloted to the end of the coal-stores adjoining No. 3 house; and there they witnessed the expeditious system adopted for unloading the railway coal-trucks. It is a system that has been in use since 1890; but the plant for No. 3 house was not put in before 1902. There are two large sunk coal-hoppers here, with breakers below. A truck is run over one of these, and upended by a powerful overhead hoisting crab—consisting of a travelling arm, chain, and wheel. How quickly the work of discharging a 10-ton truck can be peformed was demonstrated. Then the visitors saw the coal raised by the elevators, and, passing into the coal-store, witnessed its deposit there from a band conveyor. It might be

explained that the 1890 coal-handling plant is driven by two steam-engines; while this 1902 plant is driven by two "National" gas-engines of about 44 indicated horse power—either gas-engine being capable of driving either plant. Each of the elevating and conveying plants (West's type), by the way, is able to deal with 40 tons per hour; and it was learned, in passing, that each of the three coal-stores on the works has a capacity of 4000 tons.

Regarding the retort-houses at this station, ancient and modern methods may be seen, but the ancient has been relegated to the position of a stand-by, and are little used—only in small part in the depth of winter. Nos. 1 and 2 houses each contain twenty through beds of sixes, all direct fired. But it was into No. 3—the modern equipped—house that the visitors went from the coal-store; and this contains a bench of nineteen beds of eights, 22 in. by 16 in. by 20 ft. through, worked by West's compressed-air stoking machinery and hot coke-conveyors below the stage-floor—the conveyor carrying the coke away to the yard overhead coke-screens and storage and loading hoppers. The visitors were interested witnesses of the operations of charging 7½ cwt. of coal (mostly Yorkshire and local coals are used here) into the retorts, and of the discharge of the retorts into the coke-conveyors or into the producers. Regarding gas production, it was gathered that the make of the whole of the stations last year was 1,413,965,000 cubic feet, and that the average production per ton of coal carbonized was 11,256 cubic feet. This is excellent working from the coal used. From this house with its modern and economizing plant, the old retort-houses were inspected; and the comparison of the conditions of working and of the plant was not favourable to the style of the past. The double-line type of West's air-compressor driving all the stoking machinery and the capstans about the works was examined in its beautifully light habitation; and it was understood that ere long a new compressing plant will for safety's sake be put in alongside the 1902 installation. The visitors passed in due course round the remaining plant; here and there having impromptu lectures from the Engineer, from some point of vantage, on the work that the plant was performing. For example, it was so when the company reached a new washer that has been put in, and in which the gas is treated by Bell's "Solvene" for the removal of naphthalene. There has been trouble in Oldham with naphthalene; and Oldham may—though the annoyance is admitted—console itself that it is not any exception to the general rule in this respect. Mr. Duxbury told how the higher heats for securing higher makes of gas were responsible for this particular trouble; how the choice lay between the most profitable treatment of the coal with the cheapest gas and low makes with dearer gas; and how by the washing of the gas there would be practically an immunity from the evil, as soon as ever the distribution system got fairly clear of the unwelcome substance. The evidence of experience is favourable. Last November twelve months, there were 500 complaints of naphthalene stoppages; last November, only 20.

The other plant here need not be noticed in any detail, except to say that recent additions comprise condensers, washers, and further coke-screening apparatus. In the purifier-house, where there are eight ordinary water-lute purifiers, 20 feet square and 4 feet deep (in which a bottom layer of oxide and a top layer of lime are used), Mr. Duxbury pointed out that more purifying area was required at this station, and would have to be taken in hand before long—not because the gas is not efficiently purified, but because the shortness of area imposes a heavy tax upon time and men which ought not to be the case. Another point of interest was that a Maxim-Clark benzol carburettor (capable of enriching 200,000 cubic feet of gas an hour by 1 candle) is fixed on the gasholder inlet. The Corporation, though only under a 14-candle illuminating power standard, supply (as previously indicated) gas of about 18½-candle power. Regarding the storage, there are five telescopic holders at this station, the largest of which is 200 feet diameter, with a capacity of 1,600,000 cubic feet. The total storage of the five holders is 3,200,000 cubic feet.

At the Hollinwood Station.

By the aid of the tramcars, the Hollinwood station was next visited; and there the Works Manager (Mr. James Taylor) assisted Mr. Duxbury in pointing out the features of interest, and explaining systems of operation. The central feature for the visitors here was undoubtedly the carburetted water-gas plant, because local belief has it that the water-gas plant is an inveterate nuisance. In a process such as the manufacture and purification of gas, some smell is inevitable; and these works being low-lying, the neighbourhood, when the atmosphere is heavy, is bound to have, in the direction of the wind, some smell. There is no justification for casting the whole blame for this on the carburetted water-gas plant; and, in one of those impromptu lectures of which mention has already been made, Mr. Duxbury endeavoured to convince the assembled councillors as to how little foundation allegation has got on this occasion. But experiments are now being tried to remove the possibility of all complaint arising from the carburetted water-gas plant. The only chance of the plant being a nuisance is, when the stack-valve is opened and blowing starts, by the sweeping out of the gases which may be carrying a small amount of oily vapour with them. The simple expedient is being tried of burning up these vapours by, immediately the stack-valve is opened, swinging over a gas-flame and igniting the vapours. The trial was made during the visit. There is rather a loud report at the time of ignition, but flaming and exhaustion of combustible vapours of the rushing current are over in about a minute. But if smell is avoided, report will furnish ground for complainers to work upon. From one grievance or another, there is no possibility of complete escape. This carburetted water-gas plant is of Cutler's type, with a productive capacity of 1 million cubic feet per day, and with preparation for another half-million set. The proportion of the gas used is about 25 per cent. The plant is complete in every particular, and has an oil-storage tank connected with it having a capacity of 66,000 gallons.

It is at this station that most of the reconstruction and improvement work has been carried out of late. Among the work has been the installation of West's compressed-air combined stoking machinery, further regenerative furnaces displacing old direct-fired ones, coal and coke handling plant, condensers, exhausters, boilers, naphthalene washer, a benzol carburettor, and new 30-inch and 18-inch governors. Land has also been purchased for a new holder of 3½ million cubic feet capacity; and tenders have already been let (to Messrs. R. Dempster and Sons) for coke elevating and screening plant, and for purifiers of much larger capacity than those at present in use. So that it is seen there have been, and there are still to be, busy times at these works. The station, it should have been mentioned, is situated on the banks of the Manchester and Ashton-under-Lyne canal, but has no railway connection. The old coal-gas plant on the easterly side of the canal is now disused, and partly dismantled; the existing works being situated on the west side of the canal. Up to 1905, all the retorts were direct-fired; and in No. 3 house there are still 24 through beds of direct-fired sixes. In No. 2 house, there were formerly twenty direct-fired settings, having a productive capacity of 900,000 cubic feet per twenty-four hours; but these have been replaced by 16 regenerative settings of eight retorts, 22 in. by 16 in. by 20 ft. long, operated by West's stoking machinery, and having a productive capacity of over 2 million cubic feet. Such have been the scientific advances in carbonization since direct-firing held sway in gas-works practice. These settings, by-the-by, were put in by Messrs. R. Dempster and Sons, and are fitted with Waddell's patent tubes. Again, there is no necessity to go over the plant in detail. From the coal-handling plant, throughout this No. 2 house, to the outside coke-hoppers it was seen that the equipment is quite up-to-date.

Of course, it was in No. 2 retort-house that the visitors spent most of the time; and as daylight was beginning to fail, only a hasty survey of the remaining plant could be made—boilers, the Clapham "Eclipse" condensers, the exhausters, tower and washer scrubbers, purifiers, station meters, and holders. The largest set of purifiers is fitted with Jager grids; and a contract has been let to Messrs. Dempster and Sons for boxes of much larger capacity fitted with "Hurdle" grids. The four existing holders have a combined capacity of 2,200,000 cubic feet, which accommodation the holder previously referred to as shortly to be erected will supplement to the extent of 3½ million cubic feet. The total productive capacity of the works is about 4½ million cubic feet. Nothing more need be said about this station.

The Oldham and Royton Stations.

Although these two stations were not visited, it will not be out of place for the information of readers who are unacquainted with the Oldham works to quote the following information from the General Manager's card notes.

The Oldham gas station dates from 1826, is connected with the Lancashire and Yorkshire Railway, and has a productive capacity of 1 million cubic feet per 24 hours. There are three holders here, with a combined capacity of 980,000 cubic feet. All the retorts are direct-fired, and all stoking is done by manual labour. Machinery is used for breaking, elevating, and storing coal. The works are only used for gas-making purposes during six months in the year—September to March. The central store rooms, pipe yards, and workshops are at these works.

The Royton station was utilized for the last time for gas-making purposes on Oct. 14, 1907. Owing to the increasing requirements of the district, a 24-inch main from Hollinwood Gas-Works was continued to Royton, and nearly the whole of that district is now being supplied from those works. The Royton works, with the exception of the gasholder, are now finally discarded, and will shortly be demolished.

A Dinner.

The members of the Corporation and the visitors were the guests of the Gas Committee at dinner in the evening at the Town Hall. Alderman Thompson, J.P., the Chairman of the Gas Committee, presided; and he had with him the Mayor (Alderman Gourlay) and the members of the Gas Committee. In addition, Mr. Arthur Andrew and Mr. Duxbury and the other officials of the Gas Department were present; colleagues in other departments were represented by, among others, the Town Clerk (Mr. J. H. Hallsworth), the Deputy Town Clerk (Mr. G. H. Gartside), the Medical Officer of Health (Dr. Wilkinson), the Borough Surveyor (Mr. E. C. Foote), the Borough Accountant (Mr. J. H. Lees), and the Tramways Manager (Mr. L. Slattery). After dinner there were several toasts, and an excellent musical programme.

Mr. S. Smethurst (Royton) proposed "The Mayor and Corporation;" and, in the course of his remarks, said that, in his opinion, it

was a splendid idea on the part of the Gas Committee to invite representatives of the out-townships to see the gas-works, in order that they might directly gain information about them.

The MAYOR, in responding, mentioned that the Corporation had always tried to keep Oldham in the forefront of commercial enterprise. They had spent thousands upon thousands of pounds on the gas undertaking, among the many interesting features of which was that last March the assets over liabilities amounted to £359,280.

Alderman BOLTON, J.P., fittingly as Chairman of the Electricity Committee, proposed "Success to the Gas Undertaking." Both Committees, he said, were working together with one object in view—that was, to give more light to Oldham and the out-districts. When so many complaints were being made about gas, it was a wonder people had not more thought of taking electricity; and he jocularly remarked that he was determined that before long electricity should supersede gas in Oldham. At which sally there was, of course, ironical laughter; and some wag turned off a number of the electric lights in the hall in illustration of the pranks played by electricity upon its users for lighting purposes.

The CHAIRMAN, in acknowledging the toast, remarked that most of those present had been over the gas-works that day, and must have been struck by their magnitude. Half-a-million of money had been invested in the undertaking; and the annual turnover was something like £167,000. It could be imagined that a great deal of money could easily be made or lost in the management of such a concern. Success certainly depended to a great extent on the management; and he was indeed glad that it had been a success. The large increase in the demand for gas, especially during the last two years, had necessitated extensive alterations and enlargements. Last year the delivery of gas was 87 million cubic feet over its predecessor. During the last eighteen years, the gas delivery had increased from 800 to 1400 million feet, or 75 per cent.; so that those present would easily understand at what a pace they were travelling. In their extensions and alterations they had taken advantage of the most recent improvements in the manufacture of gas. Expense had not been spared, consistent with economy, to keep the gas-works up-to-date; and the money had been well spent. During the last two years they had supplied their customers with free gas-cookers; and the cost of fixing them last year alone was £1177. The Committee had also taken over the entire maintenance of gas-meters, and reduced the price of gas. Notwithstanding these things, and a cost of £15,000 more for coal through the rise in price, they considered it was not necessary to increase the price of gas to consumers. The carburetted water-gas plant at Hollinwood had cost £16,000; and it had proved to be most useful. Such plants were found in all populous towns; but in Hollinwood prejudice against it existed on account of a supposed smell. The Committee and Mr. Duxbury had been much concerned about the smell at Hollinwood; and they had left no stone unturned to reduce the alleged nuisance to a minimum. Hollinwood was in such a situation that it was impossible to do without the water-gas plant unless they chose to be in the dark, and close the mills before the ordinary time. Chadderton, Failsworth, and Royton could not be supplied with gas from either Oldham or Higginshaw, owing to the elevation of these places. The demand for gas from the district had been increasing owing to the erection of new mills. The present main was found inadequate; but the additional main would put it right. The necessary supply at Hollinwood could never have been given, even this year, without the water-gas plant. Besides this difficulty, there was lack of accommodation at the railway sidings for the unloading of coal; but arrangements were being made by the Railway Company to meet this defect. The four gasholders at Hollinwood held 2,300,000 cubic feet; and the Committee would shortly be erecting another to hold something like 3,500,000 cubic feet. The effect of this would be that more gas would be stored at Hollinwood; and the necessity for water gas would become less. Turning to the naphthalene question, he said that some people had an idea gas could be economically made without creating naphthalene, but this was not the case. The Committee were told that the gas, both indoors and outdoors, did not give the light it should do, especially in the out-townships. The out-districts could attend at the gas-works at any time, and test the illuminating power of the gas for themselves. A photometer and standard testing instruments were in use; and they showed that the gas was of as high an illuminating power as it had been in former times. Gas, too, was never so cheap as now—1s. 9d. to 2s. 2d.—in Oldham, despite the increase in the price of coal. He might add that nothing should be left undone by the Commitee or their officials to meet the requirements of Oldham and the out-townships. The officials—Mr. Arthur Andrew, Mr. Duxbury, and their assistants—had been most zealous in their duty, and in giving their best service to their employers and the consumers. Both their General Manager and Engineer had been most careful to bring before the Committee from time to time every improvement that had been brought out in the manufacture, distribution, or utilization of gas. The financial position of the department was a very sound one; but, with the recent extensions and projected improvements, they would have to go soon for further borrowing powers.

Other toasts were "The Visitors" and the "Town and Trade of Oldham."

All through, the day's experiences were highly successful; and much benefit should accrue therefrom to the gas undertaking.

A large electrically-driven three-chamber high-lift pump, recently constructed by Messrs. Mather and Platt, Limited, for the Montreal Water and Power Company, is illustrated in the current number of the "Engineer." It is capable of delivering 10,500 gallons of water per minute against a head of 405 feet, or about 170 lbs. pressure per square inch; being driven through the medium of a coupling by a three-phase motor of 1600 B.H.P., which takes current at a pressure of 2200 volts and 63 cycles per second, and makes 465 revolutions per minute. This is the third and largest set of pumps of this type which Messrs. Mather and Platt have supplied to the Company.

ADMINISTRATION OF SMALL UNDERTAKINGS.

[COMMUNICATED.]

THE gas industry is perhaps least of all industries deserving of criticism on the score of laxity; but one occasionally meets with an undertaking that is conspicuously in need of better administration. The writer recently came across a balance-sheet which, when analyzed, disclosed the fact that many of the essential principles of average gas-works practice were in a great measure disregarded, with the inevitable result of a higher price for gas. It is assuredly a matter for regret that the inhabitants of a town containing a population of well over 30,000 should be compelled to pay some thousands of pounds in excess of what would be required were the undertaking under good administration. It is not intended to refer to the town by name, but merely to use the known facts to emphasize the importance of energetically keeping abreast of the times.

In this particular place, the street-lamps are entirely lighted by electricity; but this is certainly not altogether surprising, seeing that the present price of gas is over 4s. per 1000 cubic feet, and this in an excellently situated works for obtaining coal supplies at a cheap rate. The gas industry stands or falls by its own merits or demerits; and, being divided up into a number of individual units in the shape of companies and corporations, each of which has an equal opportunity of raising or lowering the prestige of the industry in its own district, it is in the interests of the many that the failings of the few should be pointed out and rectified. The appended table, containing the comparative figures of four other concerns equivalent in point of size, shows clearly the chief details in which this particular undertaking is conspicuously deficient. The companies and corporations, as the case may be, numbered from 1 to 4 in the table, are not chosen for the purpose of making any invidious comparison, but for the reason that they supply coal gas only, as does the concern in question (No. 5), and because they happen to be undertakings of an approximate size.

No.	Tons of Coal Carbonized.	Price of Gas, 1906.	Cost of Coal per Ton.	Coke and Breeze Made for Sale, per Ton.	Purification per Ton of Coal.	Receipts from	
						Tar, per Ton.	Ammonia per Ton.
		s. d.	s. d.	Cwt.	d.	d.	d.
1	Varying from 9700 to 11,600	2 3	9 4	10·1	1·9	18	22
2		2 11	13 8	11·0	5·6	21	18
3		2 6	9 0	10·9	2·9	18	20
4		2 10	13 7	10·0	1·9	12	17
Average .		2 7½	11 5	10·5	3 1	17	19
5		3 9	15 9	7·8	1·40	9	4
	Loss per ton		s. d. 4 4	s. d. 1 10	d. 11·0	d. 8	d. 15

Total loss per ton, 9s.

To examine the figures in detail, it will be observed that the cost of coal to No. 5 is much higher than to the others included in the table, though, as before stated, the town and works are in this respect very well situated. The writer can only surmise that the buying and the method of conveyance of the coal are seriously at fault. The next item, "the quantity of coke and breeze made for sale" (7·8 cwt.) shows that the retort furnaces, presumably direct-fired, are wasteful, and should be replaced by those of a regenerative type—a change which should raise the "quantity of coke and breeze made for sale" to 11 cwt. per ton of coal. The cost of purification is especially high—a fault which could probably be very easily remedied. Expensive purification can usually be attributed to an inadequate superficial area, or in a minor degree to lime purification, or a combination of both. It is well known that the secret of success in purification, whether by lime or by oxide of iron, lies in having ample area, so that the gas may pass slowly through the material. Mr. Newbigging gives the rule that the superficial area of each purifier, where four only are used, should be 0·6 square foot per 1000 cubic feet (maximum) made per 24 hours. Oxide of iron purification with sufficient superficial area should not cost more than 3d. per ton or ¼d. per 1000 cubic feet. The last two items, relating to the receipts from tar and ammonia, are unsatisfactory, especially so far as the latter is concerned, for here is a very profitable bye-product being sold at a totally inadequate price. A sulphate of ammonia plant is inexpensive in initial outlay, is easily worked, and the product always finds a ready market. It will be seen, from the preceding table, that the figures of Nos. 1, 2, 3, and 4 are averaged, so that they may be more easily compared with those of No. 5. This comparison shows that No. 5 is deficient to the extent of 9s. per ton as compared with the average of the four other concerns. This is a serious amount, and is practically equivalent to 1s. per 1000 cubic feet of gas sold.

These figures speak for themselves; and it is unnecessary to further comment on what is apparent to all, except to again reiterate the above-mentioned fact, that the position of the gas industry is not improved by the inefficiency of individual undertakings.

A COLLECTION OF GAS ARTICLES.

It is of some interest to note that, in the last published volume (No. CLXIX.) of the "Minutes of Proceedings of the Institution of Civil Engineers," there are more than a dozen abstracts of papers and articles appertaining to gas engineering and the gas industry. Of course, certain of these are mere summaries of matter that has already been fully given in the columns of the "Journal;" but there are others of an ancillary interest to which we propose, in this collective article, briefly to call attention. It is a tribute to the increasing and widening activities of the gas industry that, in a volume embracive of all aspects of civil engineering (the scope of which is almost limitless), there should be such a proportion of matter of interest to the gas manager. With the exception of gas purification, almost every department of gas operations comes in for notice—from retort-house stoking to high-pressure distribution, and from gas-engine construction to street tarring.

Carbonization.—The very successful results of West's stoking machines at Crefeld are noted by Herr Lubszynski; but these are practically the same figures as were given in the "Journal" some time ago, and need not be repeated. The standard of health of the men is higher now than it was under the old system of hand-charging, and they are more contented.

M. Cabrier's automatic arrangements for charging horizontal retorts have also been described more than once in our columns, when reviewing the annual proceedings of the Société Technique du Gaz en France.

The relation of gas manufacture to coke-oven distillation is considered by Herr Schreiber. He points out that it is essential for the gases to escape rapidly from the heated area. In vertical retorts this is effected easier than in horizontal; and vertical coke-ovens would offer the same advantage if their cost was not prohibitive. By having two ascension pipes, instead of one, to a horizontal coke-oven, it was found that the yield of ammonia increased by 0·15 per cent. Bearing in mind the advantages of automatic charging and drawing, and the necessity for gas-producing purposes, of large heating capacity, the author recommends a vertical retort of about the same section as that of a coke-oven. Compressed coking coal forms the best metallurgical coke; and this fact has suggested the distilling of coal briquettes to which lime has been uniformly added in proportion to the sulphur contained. The result was that briquettes with 3·5 per cent. of lime added gave a yield of coke of 69·77 per cent., as against 68·56 per cent. from briquettes without any lime. The lime briquettes gave 12,009 cubic feet of gas per ton; while those without lime made 11,302 cubic feet. In sulphur, per 100 cubic feet, there were, in the gas from the lime briquettes, 37·1 grains in the crude gas, as compared with 195·2 grains in the gas from the briquettes without lime. This reduction, of course, saved the purification costs. The ammonia produced was also about 25 per cent. higher from the lime briquettes. It is said that the lime had no bad effect on the residual coke.

An account is given of making a leaky gasholder tank water-tight by means of shrinking on hot wire ropes, as described by M. Despierre at the Société Technique meeting in 1906.

Distribution of Gas at High Pressure.—This is an article by M. Paul Raulin contributed to "Le Génie Civil." The writer says that as the calorific power of the gas is now so much more of consequence than its illuminating power, and as the tendency is to supply larger and larger areas from one central works, so gas will have to imitate electrical distribution and be sent over longer distances at greater pressure. This can be done by compressing pumps at the works, and by having reducing valves at the chief points of consumption. The effect of compression on various gases is not yet clearly ascertained; but it is believed that its calorific value is unaffected. The objections are twofold: Firstly, it is said that a small leak would mean a large loss, and, secondly, on the score of increased danger. The replies to these objections are, to the former, that greater care must be taken with jointing the mains; and, to the latter, that duplication of reducing valves and installation of relief valves would tend to minimize the danger.

The radiation of incandescent mantles is discussed by M. Foix, who shows that it is considerably increased by adding traces of cerium oxide to the thorium oxide. The emissive luminosity of a thorium-oxide mantle is zero, but of a cerium-oxide mantle nearly unity. If the percentage of cerium were increased in a thorium mantle, the advantages accruing therefrom would be counterbalanced by a reduction in the high temperature of 1530°C. of the thorium mantle, which is requisite for good luminous emission. Theoretically, the thorium oxide is unnecessary; but in practice it is essential as a framework for the cerium oxide, which would be too fragile by itself.

Gas-Engine Cylinder Construction.—Two articles by Mr. E. F. Lake and Mr. Hugh Dolnar are summarized from the "American Machinist" of January last; but there is not much of particular interest in them to the gas engineer. The air-cooled cylinder is more especially the American type, while water cooling is the European practice. It is curious to note that where a fan is used for cooling in front of the engine, it is the cylinder that is furthest away from the fan that is the coolest, while the one nearest is the warmest. This is accounted for by the fact that the tips of the fan blades throw the largest volume of air, which thus reaches the most distant cylinder. A 4½-inch Corbin air-cooled cylinder weighs only 21 lbs. 4 oz., and has 18 rows of steel combs, each 1½ inches wide, fixed into grooves, the machinery of which requires twenty operations.

Suction Producers, with Special Fuels and for Special Purposes.—At Güsten, Anhalt, Germany, a single-cylinder gas-engine of 113 H.P. generates the electric current; the gas being made in a producing plant using local lignite briquettes, which cost 12s. per metric ton. The briquettes, which must be small to prevent scaffolding, are preliminarily heated in a chamber above the furnace before entering the latter. The cost per actual horse-power-hour varies between 0·20d. and 0·24d.

Sweden, as is well-known, is a great peat-bog country, about 10 per cent. of the whole surface being of that constitution. It is not surprising, therefore, that in recent years great efforts have been made towards the practical utilization of peat in suction producers. Formerly anthracite, coke, or charcoal was used; but these fuels, together with coal, were expensive. Rather contrary to the general opinion, it is stated that a certain proportion of water in the peat fuel is a benefit. A dry summer spoils the peat for gas production, as dry bog fails to give off gas free from tar. Peat containing 27 per cent. of water and 6 per cent. of ash in a Körting generator gave a gas composed of 11·4 per cent. of carbonic acid, 16·8 per cent. of carbonic oxide, 8·3 per cent. of hydrogen, 4·8 per cent. of light carburetted hydrogen, and 58·7 per cent. of nitrogen. Dry peat mixed with 50 per cent. of coke has also been successfully used in Pintsch gas-producers. In the Burängsberg mining district, with peat containing 39·71 per cent. of moisture, 4·38 per cent. of ash, and 54·91 per cent. of combustible material, the result with a 67 B.H.P. engine was a consumption of 2·46 lbs. of peat per horse-power-hour. It is clear that special local circumstances conduce to the economical use of suction-gas plants.

From a long paper to the Swedish Technical Society on suction-gas plants for vessels, it is gathered that great developments in this respect are being made. It was only in 1902 that the first cargo boat was equipped with such machinery, of 30 H.P., by the Deutz Gas-Motor Works for plying on the Rhine, and Dutch and French canals. Since its success, many other such plants have been adopted—by Messrs. William Beardmore and Co., and by Messrs. J. I. Thornycroft and Co., among others. The difficulties are connected with the inability of reversing, complicated gearing for going astern, and the danger of poisonous gas leakage in rough weather.

To revert for a moment to the use of peat fuel, it may just be said that the most modern and economical method is to convert it into coke—a process first carried out in Germany by Martin Ziegler. It is carbonized in vertical retorts, and as from its moisture and nature it must be a difficult material to manipulate, it occurs to us that some investigation as to vertical retorts for carbonizing peat might possibly assist in solving certain of the problems of carbonizing coal in such retorts. The latest vertical peat plant is at Beuerberg, in Germany, where the bye-products saved are paraffin, phenolates, gas-oil, ammonia, &c. The best peat gives 33 per cent. of coke, 4 or 5 per cent. of tar, 4 per cent. of tar water, and 22 per cent. of gas.

The up-to-date gas engineer must keep well informed on all kindred methods of carbonization and utilization of bye-products; and it is for this reason that we have drawn attention to such correlated processes as have been mentioned.

GAS ANALYSIS FOR COMMERCIAL PURPOSES.

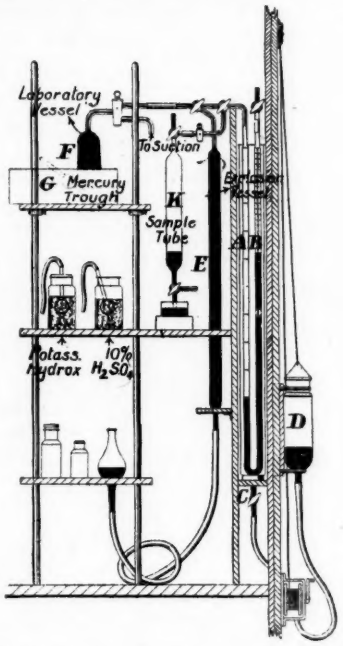
Messrs. Bone and Wheeler's Apparatus.

In the "Journal" for the 17th ult. (p. 838), brief reference was made to an apparatus for analyzing gas for commercial purposes which had been exhibited and described by Professor W. A. Bone, D.Sc., F.R.S., and Mr. R. V. Wheeler, M.Sc., at a meeting of the Yorkshire Section of the Society of Chemical Industry, held the preceding week in the Fuel and Metallurgical Department of the University of Leeds. The text of the communication, with notes of the remarks on it, is contained in the current number of the Society's "Journal," from which we reproduce it.

The authors make this communication in response to repeated requests for a convenient and not too costly adaptation of the gas analysis apparatus used throughout their researches on combustion, which shall meet the daily requirements of a commercial research laboratory. Their research apparatus, which was erected ten years ago, embodied, in its essential features, the principles of that originally devised by the late Sir Edward Frankland, and subsequently modified by Professors Herbert M'Leod and Harold B. Dixon. Since its erection, it has been in continuous daily use in the laboratories of Owens College, Manchester, and the University of Leeds for upwards of 3000 analyses, including explosion analyses of mixtures of oxygen with such hydrocarbons as methane, ethane, ethylene, acetylene, propane, propylene, trimethylene, butane, and butylene, as well as the analysis of the products of the partial combustion of these hydrocarbons, and of different forms of producer gas, water gas, natural gas, oil gas, coal and coke-oven gas, septic-tank gas, blast-furnace gas, &c. It has proved to be so admirably adapted to all these varied requirements, that the authors decided to introduce such modifica-

tions in details as would, without sacrifice of its essential features, bring it within reach of most technical laboratories; and now after more than a year's daily trial of the modified apparatus, they feel that it can be confidently commended to all who desire to have a thoroughly reliable instrument.

The essential requirements of a "commercial" apparatus with any claims to precision are: (1) Accuracy of measurement, including, of course, the maintenance of a constant temperature in the eudiometer; (2) sufficient capacity to allow, in an explosion analysis, of the proper dilution of the "explosive mixture" ("*Knallgas*") with excess of air or oxygen; (3) absorption arrangements such as will permit of the use of small volumes of freshly-prepared—*i.e.*, previously unused—reagents; (4) rapidity of action; (5) adaptability to gases of widely different compositions and richness; and (6) simplicity and general convenience of design and working arrangements. Many, if not most, of the forms of apparatus commonly in use are very deficient in regard to the second, third, and fifth of these requirements, however satisfactory they may be in other respects; while some of them involve the use of absorption vessels which are either needlessly elaborate or liable to fracture. The authors duly considered all these points; their aim being to reduce everything to its simplest terms consistent with convenience and accuracy of working.



The general character and arrangement of the various parts of the apparatus will be readily understood, with the aid of the accompanying diagram, by all familiar with the methods of gas analysis. It comprises essentially three parts: (1) A water-jacketed combination of measuring and pressure tubes A and B, communicating, through the glass tap C, with the mercury reservoir D; (2) an absorption vessel F, standing over mercury in a mahogany trough G; (3) an explosion-tube E, fitted with firing-wires, and connected with a separate mercury reservoir H. All the connections between A, E, and F are of capillary bore throughout, with suitable glass taps wherever necessary. The diagram also shows how connection is made between the measuring-tube A and the special "sampling-tube" K, whenever the latter is employed for the introduction of the sample under examination. The sample may also be introduced into the apparatus, from an ordinary test-tube, under the wide open end of the absorption vessel F, which has been previously filled with mercury. Before commencing an analysis, the whole of the apparatus, including all the connections between A, E, and F, is completely filled with mercury; and, needless to say, all the subsequent operations are conducted over mercury.

The various parts of the apparatus are suitably mounted on a strong wooden stand (mahogany, oak, or teak), with four vertical steel rods supporting the shelf upon which the mercury trough G rests; the same rods also carrying another shelf for reagent bottles. Proper provision is made for the raising or lowering (to the ground level, if required) of the mercury reservoir D, by means of a wooden carrier with suitable pulley and ratchet-wheel. The whole apparatus stands in a wooden tray 2 ft. 4 in. by 1 ft. 6 in., with 1-inch raised sides.

The salient features of the working of the apparatus are as follows:—

1.—The principle of measurement employed is that first introduced into gas analysis by Regnault, and subsequently adopted by Sir Edward Frankland—viz., the measurement of the pressure of the gas (in mm. of mercury) at constant volume. For this purpose the gas is brought to a certain "constant volume" mark in the measuring-tube A (by suitable manipulation of the mercury reservoir D and the tap C), and its pressure read off on the pressure-tube B. There are a series of such "constant volume" marks on A, each coinciding with a 100 mm. mark on the pressure-tube—*i.e.*, with 0, 100, 200, &c., mm.—so that the actual pressure of the gas is given by subtracting from the "pressure reading" the numbers 0, 100, or 200, &c., according to the particular "constant volume" mark selected for the analysis. The tubes A and B are made in one piece, which is surrounded by a water-jacket, and their inner surfaces are kept moist with very dilute sulphuric acid (1 in 20) as a precaution against the accidental fouling of the measuring-tube with alkalis; and it is obvious that the wetting of A and B with the same liquid eliminates the influence of water vapour upon the gas measurements—the various pressures representing those of the dry gas under examination. The tap closing the upper end of the pressure-tube is connected with it by means of stout rubber pressure tubing—a device which gives a perfectly tight joint with sufficient elasticity to prevent fracture in case the mercury in the tube B is inadvertently allowed to run up the tube with unusual velocity. The tap in question also allows of the vacuum being easily made in B whenever necessary. The advantages of this mode of measurement over the more usual method of determining the volume under atmospheric pressure are twofold: (1) It allows of the use of smaller volumes of gas for an analysis—thus from 5 to 10 c.c. of gas can be made to have a pressure of 100 mm., according to the particular volume mark selected, and this pressure can easily be read off to within 0·2 mm. without employing a telescope; and (2) the measurements are, of course, independent of the barometric pressure, and at the same time are unaffected by tension of aqueous vapour.

2.—The length of the pressure-tube (about 700 mm.) amply provides for the proper dilution of the explosive mixture in an explosion.* Thus in the analysis of coal gas containing (say) carbon dioxide 0·5, unsaturated hydrocarbons 5·5, carbonic oxide 6, hydrogen 55, and methane 33 per cent. respectively, if an amount of gas were originally taken corresponding with a pressure of 120 mm. at the constant volume mark O, then after removal of the carbon dioxide and monoxide and the unsaturated hydrocarbons with suitable absorbents, the residual 105·6 mm. of methane and hydrogen would give 217·8 mm. of "*Knallgas*," which could be diluted with the 350 mm. of excess oxygen necessary to ensure accuracy in the subsequent explosion. The importance of capacity is, of course, even greater in the case of a rich oil gas, or in the analysis of acetylene, where very large dilutions are necessary.

3.—The arrangements for the various absorptions are of the simplest. Instead of using a number of large absorption vessels, each containing a particular reagent which is used unchanged many times over in successive analyses, all the absorptions are carried out over mercury in the one absorption vessel F, in each case with a comparatively small volume of the particular reagent which is always used fresh and is at once discarded after use.

To facilitate the introduction of the various reagents, and the rinsing out of the absorption vessel with water or dilute sulphuric acid *in situ* between each successive reagent, the wide (open) end of the vessel is immersed under the mercury in the trough G, while the top terminates in a capillary three-way tap K. One parallel branch of this tap communicates, through a stout rubber joint, with the measuring vessel A, the other with a water-pump; a large bottle being inserted between the pump and the absorption vessel to serve as a trap for either the mercury or the reagent which is being discarded after use. The insertion of a tap between the pump and the bottle obviates the necessity of the continuous exhaustion of the latter—a single exhaustion at the outset of an analysis being all that is required.

From 2 to 5 c.c. of the particular reagent to be used is introduced into the absorption vessel (previously filled with mercury) by means of a suitable pipette, from below the surface of the mercury in the trough. Any minute bubble of air accidentally introduced with the reagent can be got rid of by cautiously opening the branch of the tap K leading to the above-mentioned exhaust bottle. The same device allows of the complete withdrawal of the reagent after use, without taking down the absorption vessel, and also of the rinsing out of the latter *in situ* with water or dilute sulphuric acid before the next reagent is used. In this way, using small quantities of each successive reagent always in a fresh condition, and washing the vessel out *in situ* between each reagent, a series of absorptions can be quickly carried out without disturbing a single connection in the apparatus. It may also be added that long experience has proved that the use of such reagents as a solution of bromine (in potassium bromide) to absorb unsaturated hydrocarbons, is unattended with difficulty.

4.—In point of rapidity of action, combined with accuracy, the apparatus will compare favourably with any other type. An analysis of producer gas can be easily carried out in 45 minutes, and one of coal gas in about an hour.

5.—There are no complicated parts about the apparatus to occasion trouble; and the several parts can be readily detached for cleaning purposes.

6.—The apparatus is well adapted for the analysis of almost every kind of combustible gaseous mixture ordinarily met with in technical practice.

* If the apparatus is required for the analysis of such diluted gases as producer gas or blast-furnace gas only, the length of the pressure-tube need not exceed 400 mm., in which case the lengths of the measuring-tube A and the explosion-tube E could be correspondingly diminished, with consequent reduction of the total height of the apparatus above the working bench. But such reduced apparatus would be unsuitable for the analysis of richer gases.

In the course of the discussion upon the communication, Mr. J. W. Cobb remarked that no branch of technical analysis had developed more the past few years than the analyses of gases, on account of the growing conviction that scientific control was essential for the economical use of fuel. The development was, however, mainly in quantity and not in quality. The Hempel apparatus was a good form for control work on ordinary combustion processes, and was easy to manipulate; but others must have felt the need which he himself had experienced for some more delicate apparatus—what he might call a reference apparatus—for use in determining with certainty the effect of comparatively slight alterations in the conditions of some process. He assumed that this apparatus was intended for reference rather than for control purposes. In comparing the results obtained by the authors in the analysis of producer gases with those generally obtained from the Hempel apparatus, the methane seemed to come out always higher—usually about 1 per cent. Now, why was this? Could comparison be made between the heating power as calculated from analysis and the same as determined by the gas calorimeter? He had always found the results from gas calorimeters, though comparable with one another, to be low compared with those from analysis, and more so than could be explained by the radiation losses of the calorimeters. Finally, he should like to compliment the authors upon some of the novel details of the apparatus, and to welcome the paper as the first contribution from the new Fuel and Metallurgical Department of the Leeds University to the Society of Chemical Industry. Mr. F. W. Richardson welcomed the apparatus, since he had to suffer a good deal from the shortcomings of other forms of apparatus for gas analysis. He noticed that there was a large number of taps, but was pleased to hear they were not likely to get out of order. He asked what lubricant Professor Bone used, and if the apparatus was suitable for extracting dissolved gases from liquids. Had Professor Bone found trouble by the action of bromine on the mercury used? Mr. C. P. Finn asked what time was necessary for the gas to remain in contact with the absorbent, and if shaking was required. He said he had always found two treatments with separate lots of ammoniacal cuprous chloride in separate Hempel pipettes necessary for the removal of carbon monoxide completely.

Professor W. A. Bone, in reply, said all the points raised had been carefully considered in designing the apparatus, and many years' experience with his own research apparatus, of which the present form was an adaptation, had convinced him of its reliability. It was not perhaps an apparatus to put into the hands of a works foreman, or possibly even into those of a novice in the laboratory; but anyone with ordinary manipulative skill and practice could be entrusted with it. It had been in daily use as a control apparatus in connection with a large producer plant under Mr. Wheeler's supervision for more than a year, and had given the greatest satisfaction. The Hempel apparatus was, in his opinion, quite unreliable and useless, except for very rough work; and he was not surprised to hear of the low methane results for producer gas obtained with it. He should never think of placing any reliance on results obtained with either the Hempel or the Orsat apparatus, where the estimation of small quantities of any given constituent was concerned, or where slight differences in composition had to be detected. He had successfully applied the most rigid tests to his research apparatus with hydrogen containing known small percentages of methane. Moreover, whenever he had had occasion to supplement gas analyses by calorimetric tests during producer triais, he had found close agreement between the two sets of results. Comparative analyses of the same sample of gas with the research apparatus and with the present apparatus showed good agreement; and though the latter was not quite capable of the same degree of refinement as the former, which, indeed, was much more costly, it was nevertheless, so far as his experience went, a thoroughly reliable instrument. In regard to the absorption of carbon monoxide by means of an ammoniacal solution of cuprous chloride, everything depended upon the care taken in preparing the solution. He always used a freshly prepared—*i.e.*, unused—solution, containing ammonium chloride, of such activity that it absorbed carbon monoxide almost as rapidly as caustic potash absorbed carbon dioxide. Careful experiments had shown, moreover, that after two successive treatments of a gaseous mixture containing large quantities of carbon monoxide with such an active solution the amount remaining unabsorbed was negligibly small. He often used a solution of bromine in potassium bromide for the absorption of unsaturated hydrocarbons, but found no difficulty at all with it. With regard to taps, if these were carefully selected by a competent judge, and kept lubricated with a solution of india-rubber in vaseline, and especially if the whole apparatus was regularly washed out with dilute acid after each analysis—an operation which could be performed in less than two minutes—no trouble would arise. People who experienced trouble with stopcocks sticking had largely their own carelessness to blame. In these days, when gaseous fuels played so important a part in industrial operations, the need of exact methods of gas analysis could not be too much insisted on; and the present apparatus was designed to meet this need.

We are pleased to learn that Sir John Aird, Bart., is so much improved in health that he has been able to leave his residence, Wilton Park, Beaconsfield, for London.

THE "ROSS" PATENT MANTLE.

Anything in the way of gas mantles that comes before us claiming increased durability merits respectful consideration; for in durability, as well as lighting efficiency, reposes much of the success of the incandescent gas-lighting system. There have been several workers striving, with more or less encouraging result, to put into the gas mantle greater strength; and we welcome the successful results of all such workers. Herr W. Büsché, the General Representative of the Deutsch Amerikanische Gasglühlicht Gesellschaft, has introduced to notice another mantle for which both increased durability and illuminating efficiency are claimed. It is certainly a mantle of interesting points; and the sample we have tried exhibited a remarkable tenacity before succumbing to the violent ordeals to which it was subjected. The durability of a mantle depends both upon its fabric and its impregnation. An inferior fabric will lead to an inferior and inflexible structure, and parsimony in the constitution of the impregnating fluid will also assist in producing a weakly mantle both in structure and illuminating effect. In both respects, the mantle known as the Ross patent—now being introduced into England—deserves good word.

The fabrics of mantles are either knitted or woven; the fabric of this mantle cannot be classified under either system of production. The materials composing the fabric are twisted; and the main parts of the Ross invention consist of the machine by which this is accomplished and of the resulting twisted product. The materials employed are asbestos and ramie; and a mantle so constituted is of more than ordinary interest. The asbestos composed ribs (in a "C" mantle there are about ten of these ribs) run from top to bottom of the mantle, and rather less substantial asbestos threads form the bracings between the vertical ribs in diamond fashion—the intervening spaces being filled by ramie. The head of the mantle is likewise specially strengthened. The ramie itself also undergoes special treatment in its preparation. One of the difficulties in dealing with the raw ramie is to relieve it from the gum it contains—the percentage varying from 20 to 80. With only 20 per cent. of gum, it is very easy to remove it without damaging the ramie; but if the percentage is as high as 80, the usual method is to use a very strong chemical solution in a bath to remove it, and this is said to have a deteriorating influence. It is to avoid this that the manufacturers of the ramie employed in these mantles have a system of their own for cleaning the material. The system is not so cheap as the more rapid method of chemical treatment. But injury to the material we are told is, in this case, the penalty that must always be paid for cheapness and rapidity.

About the composition of the impregnating solution, there is nothing to be said, except that the exact formula is kept a private matter by the manufacturers. But this can be said, that there is good substance in the mantle, which is evidence of the makers not starving the mantle, at the expense of results and reputation. The makers do not attempt to realize more than 500 mantles from 1 kilo. of the chemicals employed, instead of 1000 to 1500, as is the case in some factories.

This generally gives an idea of the care and steps taken to get strength and efficiency combined in this mantle, and so make it applicable to all purposes for public as well as private lighting. With regard to strength, the mantle has been subjected to Professor Drehschmidt's and other shocking-machines, and has sustained both vertical and lateral shocks, to the number of hundreds and at intervals of use on the burner, with reported most satisfactory results. In ordinary use, such violent shocks as these machines give are really never experienced. The wearing effect of unceasing vibration is an altogether different matter; but mantles that will stand well the shocks of these machines certainly deserve a good character for strength. As to illuminating power, a mantle with a consumption of 150 litres of gas (5¼ cubic feet) we are told will, on an ordinary burner, render an illuminating power of 136 Hefner units, or, in other words, 26 Hefner units per cubic foot of gas. This is such a remarkable result that information as to the conditions under which it is obtained—quality of gas, pressure, and so forth—would be of interest.

The mantles are made in all sizes and types, for high and ordinary pressures and for vertical and inverted burners. Herr Büsché informs us that the present idea is to work the mantles through gas companies and committees, as their responsibility for public lighting and maintenance of consumers' burners, and their interest in ensuring the satisfaction of their private consumers, constitue them the best channel for earning popularity for a mantle when merit has been proved.

To-night (Tuesday) a trio of papers on stresses in dams is announced to be read at the ordinary weekly meeting of the Institution of Civil Engineers, Westminster. The first is entitled "Experimental Investigations of the Stresses in Masonry Dams subjected to Water-Pressure," the authors of which are Sir John W. Ottley, K.C.I.E., and Mr. Arthur W. Brightmore D.Sc. The second paper deals with the same subject, and records the stresses found by means of india-rubber models. This, which is the longest contribution of the three, is by Messrs. John S. Wilson and William Gore. The last paper is a short mathematical one, prepared by Mr. Ernest Prescot Hill. Altogether, the meeting should prove most interesting.

A LONDON TAR DISTILLERY.

South Metropolitan Gas Company's Works at East Greenwich.

THERE are to be found at East Greenwich many objects of interest to those who are connected with the gas industry—a fact that is generally recognized when opportunity presents itself for a visit. Hence it is not to be wondered at that there was a good muster of members of the London and Southern District Junior Gas Association last Saturday afternoon in the neighbourhood of the Blackwall Tunnel, to take advantage of an invitation which had been extended to them to inspect the South Metropolitan Gas Company's Tar Works, at Ordnance Wharf.

These works, readers of the "JOURNAL" need hardly be reminded, were acquired by the Company some few years ago from Messrs. Forbes, Abbott, and Lennard—the precise date of the transfer being July, 1903—and they are separated only by a roadway from the Company's East Greenwich gas manufacturing station (where is to be seen, among other things, the huge 12 million cubic feet holder). On the opposite side of the gas-works—separated from them also by a road—are the chemical works, which were purchased by the Company some time ago from Messrs. F. C. Hills and Co. All three—gas-works, chemical works, and tar works—enjoy the advantages of extensive river frontage; and each, it is superfluous to remark, is an excellent example in its own particular line. Just now, however, we are concerned only with the tar works, which were the objective of last Saturday's journey to East Greenwich. On arrival at the works, the members were taken into a large laboratory, where various tar products were set out and labelled for their inspection; and thereafter they were divided up into two parties, one of which was shown the tar-distilling plant and pitch-loading arrangements, while the other was being made acquainted with the numerous further processes carried on. No effort was spared to explain to the members—as fully as could be done in the course of an afternoon which passed all too quickly—the different operations; and at its close the visit was agreed to have been both pleasant and profitable. The position of guide over the tar and pitch portions was undertaken by Mr. S. S. Field, the Manager of the works. In fact, Mr. Field can really be called more than this; for he is almost a part of the works, which he has seen built practically in their entirety. He took up the position of Manager in about the year 1884; and when the works were acquired by the South Metropolitan Gas Company, he was taken over as a portion of the "going concern." The second guide, who also spared no pains, was Mr. Hugh James, who is Chief Chemist of the works.

As showing the extent of the operations carried on, it may be remarked that the quantity of tar annually dealt with at the works (which occupy a site extending over 6½ acres) is something like 11,000,000 gallons; the tar being conveyed from the East Greenwich Gas-Works by means of a 9-inch main, and from all the rest of the stations by tank barges. For its reception, there is provided an immense underground tank or reservoir, capable of holding no less than 1,300,000 gallons. The advantage of this ample storage accommodation is obvious; for, having it, Mr. Field is not obliged to work up all the tar which comes to hand during the time of the heavy winter make of gas, but can reserve a portion of it for the summer. This enables the plant to be kept going under regular conditions, and it further permits of the same number of hands always being employed. Here it may be parenthetically remarked—for it is a subject to which attention cannot be drawn too often—that all the workers engaged under Mr. Field are co-partners.

There are, it may be stated, three "Lennard" continuous tar stills at Ordnance Wharf, which distil 24,000, 16,000, and 14,000 gallons respectively in 24 hours. The one working 24,000 gallons is composed of a coil, half-a-mile long, of cast-iron pipe starting at the inlet at 2½ inches diameter, and increasing gradually up to the outlet to 4 inches diameter. This coil is erected horizontally over three liquid fuel furnaces; the tar in the coil being heated up to the highest point required in the distillation. The tar pumped into this coil is hot tar which has been deprived of its naphtha and water by being used as a condensing medium in the anthracene and creosote condensers, from which it flows into a scrubbing column, where it is scrubbed by steam—the naphtha and water vapours going forward to a condenser, and so to store tanks in the ground, and the freed tar running from the bottom of the column into store boilers. From these store boilers, the hot freed tar is pumped, assisted by air pressure, into the before-mentioned coil half-a-mile long. The resistance of this half mile of coil, with tar containing about 3 per cent. of water, is about 25 lbs. At the outlet of the coil, the heated tar descends into the pitch column, where it also is scrubbed by steam. The pitch, falling to the bottom, flows through steam-jacketed pipes to the pitch coolers, and then into the pitch bays. The vapours which ascend from the pitch column pass forward into the anthracene condenser, where the vapours are cooled by means of crude tar kept at the proper temperature for the anthracene to fall. The vapours not condensed ascend to the creosote condenser, where they are also condensed by means of crude tar, kept at the proper temperature. From this condenser, the remaining vapours ascend to the last condenser cooled by water, where the water and the light oils are obtained. The whole of the condensing plant and receivers of the stills are worked with a vacuum on them to assist the distillation, and to obviate any nuisance arising from the process.

About 60 per cent. of the make is pitch; the remaining 40 per cent. consisting of anthracene, creosote, light oil, naphtha, and ammonia water. The creosote is afterwards washed for carbolic acid and cresylic acid; and the greater part of it is sent abroad for pickling timber—railway sleepers and suchlike. Granulated naphthalene is also obtained from the creosote; and the works are besides turning out a little pure naphthalene. Formerly the creosote was dispatched abroad in barrels; but now it is taken in tank steamers—in fact, it is carried as return cargo in petroleum vessels. The anthracene also goes abroad. The works are capable of turning out 1000 tons per annum of this product, if it were required; but actually they at the present time only make sufficient to render the pitch marketable. The naphtha and light oils are fractionated into benzol (for which an increasing demand is being experienced for the driving of motor-cars), toluol, solvent naphtha, &c.

With regard to the pitch itself, this is run off into bays, of which there are eight on the works. Each bay is capable of holding, when filled to a depth of 6 feet, over 1000 tons; and when the pitch has cooled, it is broken out and placed in skips. These skips, each of which holds a ton, are then conveyed, first by means of a Temperley transporter which runs on rails fixed over the bays, and subsequently by another transporter of the same name, which takes the skips to the vessels lying alongside the jetty. The rate of loading accomplished by this method is about 30 tons an hour; and Mr. Field is able to speak very favourably of the Temperley transporter, which he says has saved its cost during the seven years or so it has been in operation. In former days, 44 men used to be engaged in winning the pitch from the bays and loading it into the ships; whereas now the same work can be accomplished, with the aid of the Temperley transporter, by 16 men. In connection with this part of the work, it may be mentioned that, as there is a depth of water of 25 feet off the jetty, it is possible to load vessels of about 2500 tons. While the visitors were on the jetty, one of the Company's tugs could be seen lying in the river—easily distinguishable by the design of a small white gasholder which was round the top of the black funnel. On the jetty, also, the members had pointed out to them yet another feature, small in itself, but thoroughly characteristic of the up-to-date way that everything is carried out in this well-arranged and remarkably clean and tidy works. There happened to be a thick fog hanging over the river on Saturday afternoon, and at one end of the jetty there was a loud-toned bell sending forth a warning sound at short and regular intervals; and this bell, those present were somewhat surprised to hear, is worked automatically by means of compressed air obtained from the works.

A point to which special attention was given by the members was the heating by liquid fuel. In this connection, there must be mentioned first of all an extremely efficient-looking tar-burner which has been fitted under four of the boilers. This is the subject of a patent taken out by Mr. Field and Mr. A. Kirby, one of his draughtsmen; and it has for its object the atomizing of the crude tar, which is injected by means of steam into a fire-clay lined furnace. The proper amount of air is admitted through the burner also into the furnace; and the arrangement secures perfect combustion, with an entire absence of smoke, dirt, or trouble. The material used for the purpose is crude tar as it comes from the gas-works, with 3 or 4 per cent. of water remaining in it; and Mr. Field declares that it is more than equal, weight for weight, to good Welsh coal. The boilers under which these burners are fitted are of the ordinary Galloway type, with double furnaces converted for the purpose. Everything is taken out of the furnace; and then there is a fire-brick lining put in, and the proper openings made for the admission of air. In addition to the boilers fitted with the Field and Kirby patent tar-burner, there are also one still and another steam-boiler using liquid fuel—creosote—and there is another still for which is utilized producer gas made on the premises. Another still is at the present time being fitted up for burning tar.

In concluding this short notice of the many very interesting things seen on Saturday, one or two other matters may be touched upon as showing the completeness of the works in every respect. Electric lighting, generated on the premises, is used in all parts where dangers might be apprehended from inflammable vapours; while there is a fire-engine always ready with steam up—it being connected to the main steam-boilers. Besides this, sand is stored at different points on the works, so as to be ready for use in case of fire. These precautions are no doubt wise, in spite of the fact that everything about the place is either enclosed or placed underground. Mr. Field does all his own work on the spot, except casting; being even provided with his own cooperage for making barrels.

At the conclusion of the inspection, the members were entertained at tea; and after this, the President (Mr. W. Upton) said it was his pleasant duty to propose a vote of thanks to the South Metropolitan Gas Company for giving them permission to visit the works, and to Mr. Field and Mr. James for the trouble they had taken in showing the members round and explaining everything to them. It had been a pleasant, and what was even more important, a most instructive afternoon. It was quite evident that everything which could be done to make the business a success, was undertaken at these works.

Mr. W. J. Liberty, who seconded the vote, contrasted the condition of residuals to-day with that of years ago. He had been very gratified to learn that afternoon from both the gentlemen who had shown them round of the large quantity of products that were exported. When they heard of so many things coming into the country, it was pleasant to find that the South Metropolitan Gas Company did a good business in the export of the materials derived from their tar.

The vote having been heartily accorded, Mr. Field briefly returned thanks. He said it had been a pleasure to see the Association there that afternoon, and to note how the members appreciated what was being done. He did not think they at the Ordnance Wharf were altogether behind other people. They were trying their best to keep things up to "concert pitch;" and they would continue to do so. If any of the members would like to come and inspect the works again, he would be pleased to see them. About 95 per cent. of the goods made at the works were exported.

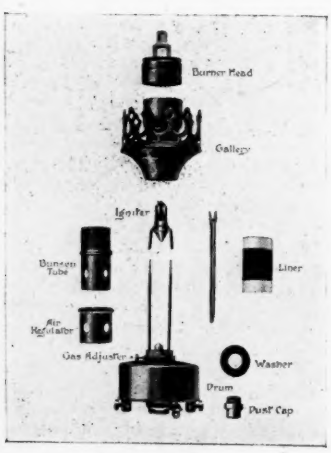
Before the meeting broke up, Mr. H. Austin, in the course of a few spirited remarks, said it was pleasant for him, as an employee of the South Metropolitan Company, to speak of the works as "our" works. The aim of the Board was to lift the worker up higher and higher; and he trusted this would be a growing aim throughout the length and breadth of the land. He hoped none of those present would fail to work for co-partnership. He was pleased to be associated with those whose anxiety it was to gain knowledge. It was a step in the right direction; and while it was contributing to their own strength, it was also contributing to the strength of the nation.

THE "TELEPHOS" LIGHTING AND EXTINGUISHING SYSTEM.

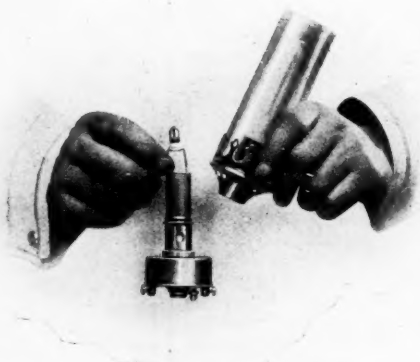
Electrical Ignition, without Pilot Lights.

It is not generally the fortune of an inventor to attain perfection straightway from principles to completed structure without encountering difficulties which are time-absorbing and perplexing in their surmounting. But when perfection is ultimately attained, there come the reward of satisfaction and, naturally, it is hoped, of something of a more material character. A few years ago we described the "Telephos" system of igniting and extinguishing gas-burners. The system was (and is even more so now) an attractive one; and it embodied a great deal of ingenuity. At the outset, it seemed that perfection had already been achieved; but time, the inexorable revealer of defects, disclosed that in certain small details there were the seats of unreliability. Those interested in the system were not daunted by this fact; but instead of prosecuting business with a system in which was involved possible dissatisfaction to the user, they wisely withdrew, and set to work experimenting and improving until now they are completely satisfied with all their arrangement, and are able to proceed to commercial development with the utmost confidence.

The improved system has been seen at the offices of Telephos Limited, at No. 115, Cannon Street. Throughout the demonstration there was not a single failure in performance; and it was found that care has been taken to guard against any untoward event causing a complete deprivation of light. It is an electrical device, worked by push-buttons from any one, two, or more positions in a room, and without pilot lights—giving to gas light all the convenience in respect of prompt lighting without a flame and prompt extinguishing that can be claimed by electricity. A small dry battery is used. In principle, the system has not been in any way changed; in mechanical details alone has there been necessary remedying work. The whole of the electrical mechanism is contained in a little drum below the burner. In the base-plate in this drum there are nine holes; and on the top of the base-plate there is a toothed wheel valve (disc valve, it is commonly known as) with nine corresponding holes. When this disc valve is in the "off" position, all the nine holes in the base-plate are entirely covered by the blank spaces of the disc valve. When a press-button is pushed, it closes the electric circuit, and the current flows through two small coils. The armature is by these means attracted, and, in flying over to the magnet, it shifts the disc valve round by one tooth, putting the holes in the base-plate and the disc valve into line, and thus allowing the gas to flow through. The same current that operates the magnets also passes through



Showing the Parts of the Arrangement at the Burner.



Showing how simply a New Igniting Device is Inserted.

The Completed Burner with Mechanism.

to a pure platinum filament igniter fitted at the burner-head, and causes the filament to glow and to ignite the gas.

This, without going too finely into detail, describes the mechanism; but there is another improvement which is of importance. In an apparatus of this description, there are all sorts of little accidents—merely mechanical ones—that can happen. But with the improved device, the user is never stranded for light, because, if the electrical gear gets out of order, and cannot be used, it is only necessary to pull a knob under the base plate, and light with a match as ordinarily. This "emergency" device is interesting. Looking into the little drum, it is seen that the pulling down of the knob has precisely the same effect on the mechanism—it sets up the same actions—as the electric current. Therefore, the convenience of the electrical ignition and extinguishing is not obtained at the cost of a possible total failure of lighting at, in all probability, some inconvenient time. This is a protection to the gas consumer of which the electric light user cannot boast. A further improvement is that there are now no loose connecting-wires or wire joints to be made between the upper part of the burner and the mechanism below. By a very simple contrivance, the mere fact of screwing the upper and the lower part of the drum case together produces the necessary contacts. Passing up the burner, we notice an adjustable needle gas-regulator, an air-regulator, and one or two other features of interest. Then we get to the beautifully designed incorrodible burner-head, which has been made of a composition and in a manner so as to ensure the minimum amount of heat being conducted down to the metal parts of the burner. On this head we get the igniting arrangement, the current to which is conducted by two side wires in the interior of the bunsen tube. This igniting arrangement is also ingeniously designed. There is a little porcelain base with the conductor wires passing through; and under a bridge at the top is the pure platinum filament which becomes incandescent on a button being pressed for lighting up. The glowing of these filaments might almost be described as momentary (only continuing for just sufficient time to ignite the gas); so that they will last for, the Telephos Company say, at least a year's ordinary wear. And a user can himself make replacements readily and at a cost of a few pence per burner. The production of these filaments is rather a delicate operation; but a couple of newly and cleverly-designed machines have placed the Company in a position of ease in this respect.

The Igniting Arrangement.

The system can be applied to single and cluster lights; and the schemes for operating different numbers of burners are numerous—too numerous, indeed, for us to mention them here. Nor is there any occasion at this time of day to tell our technical readers of the economy, convenience, and safety of such a system as this; and therefore we may leave it here with a word of congratulation upon the great improvement that has been effected. The system is, by the way, now being adapted to the inverted burner.

SHOP LIGHTING BY GAS.

Last Thursday evening, at the invitation of the Borough of Hornsey Tradesmen's Association, Mr. F. W. Goodenough, the Chief Inspector of the Gaslight and Coke Company, delivered, at the Athenæum, Muswell Hill, a lecture on "Gas Lighting as Applied to Shops." The audience was a most appreciative one; and the close attention with which the lecture was followed must have been ample repayment for the very considerable trouble that had been taken to fit up the various lamps to which reference was made, together with the switching arrangements, &c.

Mr. Goodenough prefaced his lecture by remarking that the subject with which he was about to deal was of considerable importance to tradesmen, because good light was essential to good business. It not only attracted and pleased the customers, but it ensured the staff keeping the premises and the stock in perfect order. There was nothing like darkness for breeding dirt. It was necessary, however, not only that the shopkeeper should have plenty of light, but it should be skilfully arranged so as to give the best result with the least expense. In using the light, it had to be borne in mind that it was the effect of the illumination, and not its source, that was required to be seen. In many shop windows, it looked as though lights were for sale, and not the goods in them. Windows full of small electric glow lamps were very trying to look at—one got a confused and irritated feeling, instead of being able to see the goods easily, without seeing the lights. A tradesman had first to decide what illuminant he would use, and then how he would employ it. Assuming gas was chosen, the burners and lamps had next to be selected. Of course, flat-flame burners need not be considered—they were quite out of date, though it was remarkable how many shopkeepers still used them, because, apparently, they would not spend one half-crown in order to save a great many, by adopting incandescent lighting, which would give them eight times as much light for a given consumption of gas as was formerly obtainable. The choice of burners and lamps depended partly on taste and partly on particular conditions—the distribution of light required and the character of the premises; but whatever was chosen, cheap burners and mantles should be avoided.

Having selected his burners, said Mr. Goodenough, the shopkeeper must see that he gave them plenty of pressure. With an incandescent burner, a good even pressure was wanted. He would advise a tradesman to put a governor on his supply, but not to govern the supply down to 1 inch or even less, as used to be done for flat-flames. If it was governed to (say) 2 inches, there would always be a satisfactory and even pressure; and when once the burners were adjusted to this pressure, there would be no trouble whatever. The best result would be obtained for the gas consumed, and waste would be avoided. All progressive gas companies were anxious that their consumers should avoid waste in every way. Economy in lighting, heating, and cooking was the aim of every gas undertaking that understood its business. One method by which a tradesman could avoid waste was by reading his meter once a week, and keeping a record of his consumption. While on this point, he would emphasize the danger of turning off the gas at the meter at night, in case taps should be left open, which would result in an escape when the gas was turned on in the morning. Besides this, it was always useful to have light handy at any hour, day or night. Another warning he would like to utter was in connection with water-slide chandeliers, which were always liable to become a source of danger, and should be abolished.

Dealing next with the arrangement of lights for outside and window lighting, Mr. Goodenough said an excellent way to light shop windows, where circumstances would permit, was by means of reflector lights fixed above the case in the window—thus throwing the light down on the goods, without the source of the illumination being obvious to the eye unless looked for. The lights could be switched on from any given point, for which purpose the "Pneumatic" and "Norwich" switches were now available. A really excellent effect could be secured by the means he had described. Goods could be kept quite away from the heat; and for that reason the great majority of the sweetstuff shops in London were lighted on this system, which could be supplemented in the case of shops with window-floor dressing (particularly ironmongery, china and glass, and furniture shops) by screened foot-lights, which enabled the goods to be illuminated without the source being seen outside. If the window dressing did not allow of reflector lamps being placed above the show-case, light could best be obtained by the use of reflector lamps outside the window. In fixing these, two facts should be borne in mind—first, that they should be fitted well out from the window; and, secondly, that they should be not too high, because the rays that were most effective in lighting the goods were those from the horizontal to an angle of 45° from the lamp to the window. There was another switch arrangement by which these lamps could be turned on and off from within—namely, an independent bye-pass supply running to the lamps, such as had been adopted by the Gaslight and Coke Company at the new Victoria Station, where the whole of the lamps were controlled by taps at the end of the platform. Of course, if outside lamps were needed more for advertising than for showing goods, high-power lights should be used, fixed well up, so as not to interfere with the comfort of passers-by. The use of flame arc lamps quite near down to the pavement was more likely to repel business than to attract it, and another disadvantage of this lamp was that, owing to the peculiarity of its spectrum, it produced the effect of colour blindness with regard to almost every tint. For display outside lighting, the best effect and the best economy were obtained from high-pressure lights, of which one of the latest installations could be seen at Harrod's Stores, where they had put in 24 lamps for the outside lighting of some of the windows, and had been so pleased with them that they had installed 19 2500-candle power lamps to light up the tower and the whole of the top of the building for purely advertising purposes. It surprised him that more tradesmen who had the control of the premises above their shops did not adopt the system of having not only a row of lamps outside the shop, but further rows on the floors above. It was an excellent way of attracting attention.

Mr. Goodenough remarked that, for calculating what lights he required for his frontage, a tradesman might make a rule to allow from 50 to 100 candle power per foot frontage, according to the premises he was lighting, and to his desire to get the greatest possible or merely a moderate light. This would work out at from 200-candle power for every 4 feet, to 1500-candle power for every 15 feet. An important point to be borne in mind was the necessity for proper maintenance, which was the whole secret of successful incandescent lighting. Gas companies did not charge heavy prices for maintenance, because they were most anxious to secure the advertisement which good lighting gave them; and he did not think an ironmonger would charge a high price, because he knew it was difficult to get a tradesman to spend any money at all on mantle-maintenance, and it was a means of keeping in touch with a customer if he did the maintenance at little more than cost. Money spent on maintenance was repaid many-fold, if skilled labour was employed; but otherwise the result must be unsatisfactory.

As to indoor shop lighting, continued Mr. Goodenough, the question of the adoption of small or large units depended on the size of the premises and the character of the goods for sale. Large units were advantageous where a shop was spacious and there were big spaces between the show-cases. Large units gave a bold appearance to the shop, and did not make it look crowded. Clusters of inverted gas-burners were particularly suitable, with artistic fittings, in carpeted show-rooms (such as those of milliners, dressmakers, furnishers, &c.) to which it was desired to give a furnished appearance, as well as to illuminate the premises. Of course, small units could be used in special positions in large shops, in addition to the general scheme of large power lights. In premises not so large, or where there might be high show-cases with not much space between, smaller lamps or single lights on brackets or single tee pendants, with two burners, either with upright or inverted lights, could be employed. All such fittings could be put on switches, so that however many units of light there might be, they could be controlled from a distance.

Anticipating that it might possibly be useful if he gave some basis for properly calculating the volume of light and arrangement of lights required for inside shop illumination, Mr. Goodenough said that an excellent rule to determine the total volume of light required for a shop was to allow from 30 to 50 candle power for every 1000 cubic feet of contents of the shop, according to the colour of the walls, ceiling, floor, and stock, and whether the desire was to light lavishly or moderately. As to the spacing of the light so as to ensure even diffusion, it had been found best in practice to place the lights apart about one-and-a-half times or twice their height from the floor-level. For instance, if the lights were put 7 feet from the floor-level, they should be from 10 ft. 6 in. to 14 feet apart. For businesses where a lot of dust was constantly floating about, they could use Podmore's lamp, which was specially designed so that no dust could get to the burner; while for workshops and places where there was machinery in motion, there were, of course, anti-vibration devices.

Remarking that he would now like to say a few words from the gas point of view as to the selection of gas or electricity for shop lighting, Mr. Goodenough said that naturally one of the very first things a tradesman considered was the cost, both of installation and of running. Electricity was more expensive to instal than gas, while the annual cost of lighting was also generally recognized to be heavier. Working out figures for the cost of 1000 candle-power for 1500 hours (which was about the average time of lighting in a shop), including renewals in all cases, and also the cost of bye-pass lights with gas, so as to make it equal in the matter of convenience with electricity, the result was as follows: High-pressure gas, £10; self-intensifying gas-lamps, £14; ordinary upright or large inverted gas-burners, £19; small inverted gas-burners, £22; flame arc lamps, £14; ordinary arcs, £34; osram electric lamps, £50; tantalum or Nernst electric lamps, £55; combination of ordinary arc and osram lamps, £42; and ordinary 8 or 16 candle power carbon electric lamps, £125. Flame arcs, of course, were not available for inside lighting, owing to the fumes they gave off, in consequence of the material of which the carbon was constructed. Of the osram and tantalum lamps, much had been heard lately; and some electrical undertakings actually advertised that with the former electric light was cheaper than gas. He, however, made bold to say that, if the current was supplied for nothing, it would still pay better to use incandescent gas, because the renewals of the osram lamps would exceed the cost of the gas and the maintenance of the mantles. Osram lamps were very fragile, and could only be run singly on low voltage; and the same applied to tantalum lamps. The figures he had given would

be confirmed by experience, if an exact comparison was made of light for light. But a gas consumer was more liberal in his use of light than was the customer of the electrical undertaking, with the result that, instead of the bill for gas being one-sixth that for electricity, it was generally from one-third to one-half.

A very striking case that his Company had had was the Hackney Working Men's Club, where they took out electric lamps of 4000-candle power and put in incandescent gas-lamps of 10,000-candle power; and the gas bill had been £40, instead of an electricity bill of £80. But, of course, the most outstanding instance of all was Victoria Station, where £1100 was saved in twelve months, by substituting gas for arc lamps, though they were manufacturing their own current at a cost of 2d. to 2½d. per unit. His Company secured the lighting of the new station in competition with electricity at about 1⅛d. per unit. There were, however, other circumstances to be taken into account when deciding on the use of gas or electricity, one of which was that gas was more reliable.

Mr. Goodenough then proceeded to deal with the hygienic aspect of the matter (emphasizing the great advantages of gas as a medium for ventilation); the prejudicial effect of the electric light on eyesight; the advantage of the heat given off by gas-burners—especially in spring and autumn when the lighting of a fire was often thereby obviated; the small effect of incandescent gas lighting on ceilings and decorations, except in very low-pitched rooms (the products of combustion containing no carbon whatever); the greater convenience claimed for electricity, which he pointed out was neutralized by the introduction of the gas switching appliances; and, finally, the relative danger of the two illuminants, as to which he remarked that statistics showed conclusively that there was no more danger in gas than in electricity. He then drew attention to the competition between municipal electrical undertakings and gas companies—urging that the question of which illuminant should be used ought to be decided strictly on its merits. In Islington, the street lighting by electricity for one quarter cost £262 per mile, compared with £41 per mile for gas. If the 20 miles of streets that were illuminated by electricity had been lighted by gas, on double the scale of the streets that were lighted by gas (because they were main roads), the saving to the rates would have been £3600 for one quarter. The lighting rate in Islington went up from 1½d. in the pound in 1889 to 4½d. in 1905. In Willesden, lighting 7 miles of streets by electricity cost £2920, or £417 per mile; while the lighting of 65 miles by gas cost £6252, or £96 per mile. If the streets lighted by electricity had been lighted by gas at twice £96 per mile, the rates would have been saved £1600, which had to be added to the loss Willesden made on its undertaking.

A number of questions were put to Mr. Goodenough, after which, on the proposition of Mr. J. R. Randall, he was accorded a hearty vote of thanks for his lecture. In reply to remarks made by one speaker, who differed from him on the health aspect of the question, Mr. Goodenough said that, at the request of the Metropolitan Gas Companies, very careful chemical and physiological investigations had lately been conducted by Dr. S. Rideal, and these went to prove the accuracy of the contention that electricity had no hygienic superiority over gas.

MANCHESTER JUNIOR GAS ASSOCIATION.

A Meeting of the Manchester and District Junior Gas Association was held at the Manchester School of Technology on Saturday. Mr. E. J. Wellens, the President, occupied the chair, and said the subject of the paper about to be read to them dealt with a vexed question. No doubt the various members had their own particular views with regard to it.

Mr. J. Alsop (Chief Draughtsman, &c., to the Stockport Gas Department) then read the following paper, entitled

HOW SHOULD GAS PROFITS BE DISPOSED OF?

The subject of my paper is chiefly on the question of profits from gas undertakings being handed over in relief of rates, along with other matters which enter into this question. Most gas engineers think that, in the interests of the industry, our departments should not be made the "milch cow" for the whole of the other undertakings. What, then, is the duty of the gas undertakings towards the ratepayer and gas consumer, and which of the two has to be considered first? For, as we all well know, there are a great number who are ratepayers and yet not consumers. A departure from the usual custom of contribution of gas profits to relief of the rates has been recently announced at Belfast.* This appears to be what the gas engineers of to-day are very desirous should become the rule instead of the exception, and is a step in the direction of what most people wish to see—*i.e.*, direct rating.

The question has many sides; and it has been somewhat difficult to arrange on this account. But my object is to introduce the topic more in the nature of a "study," whereby we may all hope to learn something relative to the existing conditions, and how they affect the various consumers. One of the questions which has to be considered is whether a gas undertaking owned by a municipality should be expected to make a large profit, or whether the gas should be sold at such a price as will just allow a fair margin to carry to a reserve fund. If the undertaking has to realize a profit, the question presents itself as to what should be done with the surplus. Should it be handed over in relief of the rates, or should it be utilized for the reduction of the capital, and consequently a corresponding decrease of the annual charges for interest and sinking fund?

It may be argued by some that if, instead of earning a profit, the result happened to be a loss, the amount of such loss would have to be made good out of the rates; but we all know that cases of this kind are very few and far between. Where such instances occur, they are invariably the results of councils requesting increased contributions in relief of the rates in previous years of prosperity—such request having been complied with by the gas committee at the expense of their own undertaking, which had to suffer in subsequent years. Taking the case of profits being applied in reduction of capital, the gas consumer reaps the benefit, as, in consequence of smaller annual charges, the price can be materially reduced, and the undertaking would shortly be free from debt altogether, which we must admit is a state of things greatly to be desired.

Take, for instance, an undertaking which has to hand over £20,000 for the relief of rates. If they were allowed to transfer this amount towards the reduction of the capital account, it would result in a saving of £1400 (the average interest and sinking fund works out at 7 per cent.), so that during the second year there would be an increase of profits. For example:—

£800,000 capital, at 7 per cent. = £56,000 = amount payable to interest and sinking fund in the first year.
20,000 profits transferred to reduce capital.

£780,000, at 7 per cent. = £54,600 = amount payable to interest and sinking fund in the second year—a gain of £1400.
20,000 profits transferred to reduce capital.

£760,000, at 7 per cent. = £53,200 = amount payable to interest and sinking fund in the third year—a further gain of £2800.

So that in three years time you would have gained £4200, and have a still increasing figure, which could be utilized for reduction of gas charges.

Another point is whether any profit should be made at all, or whether the gas should be sold at a price just sufficient to cover all expenses of manufacture, maintenance, distribution, and standing charges. The special point about this system is that, if there were no profits, there would be no income-tax to pay; and in a number of cases this alone would result in considerable saving, as large sums are paid annually by gas undertakings.

Below are given a few tables which show what are actual facts when gas profits are used for the relief of rates, and comprise private houses, shops, hotels, and mills. In the latter case, instances are given where very little gas is used, and others where there is none employed for lighting. It may be well to say that these figures have been arrived at as follows:—

$$\frac{\text{Amount in pence handed over in relief of rates}}{\text{Assessable value of borough} - 6 \text{ per cent. for unoccupied property}} = \text{Pence in the pound that the ratepayer gets on account of gas profits.}$$

The next factor required is the amount in pence per 1000 cubic feet of gas sold that each consumer has to pay so as to realize what is handed over in relief of rates, which can only be got at, as far as I can see, in this way (this being an average figure):

$$\frac{\text{Total amount handed over to relief of rates}}{\text{Number of cubic feet of gas sold, in thousands}} = \text{Pence per 1000 cubic feet that is to realize the profits.}$$

From figures I have before me, and following out the above formula, the profit or amount paid in excess for gas per 1000 cubic feet consumed to realize the amount handed over for the relief of the rates was 5½d., which is a fair average of most undertakings. In a similar manner, the amount by which the rates were relieved was 8d. in the pound.

From a glance at the tables (p. 167) it will be readily seen that the consumer who has a large consumption in proportion to his rateable value is actually a loser under existing conditions, though it is he who contributes most to the profits of the undertaking.

Another point that forces itself upon us is: Why are electrical undertakings allowed to supply their current at practically cost price when gas undertakings are expected to make a large profit? If gas undertakings were allowed to supply their gas with as small a margin of profit as electrical undertakings are allowed to do, there would be no competition at all—electricity would simply be wiped out as an illuminant, and would be regarded as a luxury. In other words, if electrical undertakings had to hand over in relief of rates a sum which would represent the same percentage on capital as the amount handed over by gas undertakings represents on their capital, the price of current would have to be increased to such an extent as to make it absolutely prohibitive (unless economy be not considered), as the following tables amply show. I may mention that the towns that are taken all have good-sized undertakings.

There are many places where ratepayers have for years been made to pay an exorbitant price for street lighting by electricity, to help a heavily capitalized electricity undertaking. What we want is equal treatment. When the gas undertaking was in its

* See "Journal," Nov. 12, p. 510.

PRIVATE HOUSES.

Annual Consumption. Cubic Feet.	Stove.	Rateable Value.	Paid in Excess for Gas to Relieve Rates.	Received by Relief from Rates.	Annual Gain.	Annual Loss.
Thousands.		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
14·0	—	5 15 0	0 6 1	0 3 10	..	0 2 3
8·0	—	7 0 0	0 3 6	0 4 8	0 1 2	..
10·0	—	17 0 0	0 4 4	0 11 4	0 7 0	..
28·0	—	19 5 0	0 12 3	0 12 10	0 0 7	..
43·0	—	23 15 0	0 18 9	0 15 10	..	0 2 11
66·0	Stove	35 0 0	1 8 10	1 3 4	..	0 5 6
52·5	,,	42 0 0	1 3 0	1 8 0	0 5 0	..
77·5	,,	43 15 0	1 13 11	1 9 2	..	0 4 9
49·5	—	52 10 0	1 1 8	1 15 0	0 13 4	..

HOTELS.

483·5	Stove	289 0 0	10 11 6	9 12 8	..	0 18 10
326·5	,,	153 0 0	7 2 10	5 2 0	..	2 0 10
223·0	—	153 0 0	4 17 7	5 2 0	0 5 5	..
171·0	—	63 15 0	3 14 10	2 2 6	..	1 12 4
158·0	Stove	148 15 0	3 9 2	4 19 2	1 10 0	..
141·0	,,	42 10 0	3 1 8	1 8 4	..	1 13 4

SHOPS.

146·0	—	35 0 0	3 3 10	1 3 4	..	2 0 6
141·0	—	105 0 0	3 1 8	3 10 0	0 8 4	..
161·5	—	63 10 0	3 10 7	2 2 4	..	1 8 3
223·0	—	43 15 0	4 17 7	1 9 2	..	3 8 5

MILLS.

1239	—	92 0 0	27 2 1	3 1 4	..	24 0 9
7665 *a*	—	1014 0 0	167 13 5	33 16 0	..	133 17 5
1054	—	114 0 0	23 1 1	3 16 0	..	19 5 1
230	—	2535 0 0	5 0 7	84 10 0	79 9 4	..
301	—	2434 0 0	6 11 8	81 2 8	74 11 0	..
none *b*	—	545 10 0	..	18 3 8	18 3 8	..
none	—	1737 0 0	..	57 18 0	57 18 0	..
288	—	3557 0 0	6 6 0	118 11 4	112 5 4	..

a. Industrial purposes and lighting. *b*. Lighting only.

ELECTRICITY UNDERTAKINGS.

Town.	Capital Account.	In Aid of Rates.	Reserve.	Rate per Cent. upon Capital.
1	£817,293	..	£6,097	..
2	56,763	..	290	..
3	271,481	..	1,801	..
4	2,267,127	..	16,219	..
5	568,577	£10,000	.	1·7
6	186,857	2,750	..	1·4

GAS UNDERTAKINGS.

[Same towns taken; and the numbers in each case correspond.]

Town.	Capital Account.	In Aid of Rates.	Reserve.	Rate per Cent. upon Capital.
1	£2,908,949	£58,546	..	2·0
2	141,763	7,613	..	5·3
3	1,258,649	38,466	..	3·0
4	2,544,802	60,000	..	2·3
5	906,799	23,630	..	2·6
6	288,564	13,000	..	4·5

infancy, it had its way to make; and the price of gas was fixed so as to ensure this.

A question that may have troubled one or two of our members is, Why need our works pay rates? Some people think it is a case of "robbing Peter to pay Paul." The reasons are: (1) By law the only places exempt from rates are charitable institutions, places of worship, and Government property; every other building, &c., being rateable. (2) The valuation list of every town must include all rateable property; the total rateable value as per the valuation list being the amount on which the rates are calculated. (3) A borough is not self-contained. For some of its services it is dependent on the county of which it forms part; and also for poor-rate purposes it is usually connected with other surrounding districts. To apportion the expenses between the county and the borough, the rateable value of the borough in proportion to the rateable value of the county is taken as the basis. Thus, if the corporation undertakings—such as gas-works, &c.—were omitted from the valuation list, and therefore from the rateable value of the borough, the borough would not be paying its proper proportion of expenses, and other towns and districts would suffer in consequence.

In conclusion, I would like to say that I have been unable to use the figures that one or two of our members have been so kind as to furnish me with, on account of the varied condition under which their departments work—some cases being restricted as to the amounts they shall hand over—so that I have dealt with figures from official publications.

Discussion.

The PRESIDENT said they were much obliged to Mr. Alsop for the paper. The strong point in it was that relating to a comparison between gas and electricity as an illuminant. His own opinion was that each corporation undertaking should stand on its own footing. It was unfair that gas consumers should have to subscribe to the rates to pay for the losses on the electric lighting and other departments. The ratepayers who were gas consumers got no benefit out of the surplus profits obtained from gas consumption.

Mr. MERCER (Widnes) said at Widnes, as they had heard, the Corporation were debarred by statute from using gas profits for any other than gas-works purposes; they could not be applied to the relief of the rates. The question had been thrashed out in the town. By the operation of the particular clause governing the matter, the price of gas had now been reduced to 1s. 3d. per 1000 cubic feet; and under favourable circumstances, the charge might be still further lowered. It had been found that every reduction in the price of gas was followed by increased consumption. It was an inducement to manufacturers and traders of all sorts to come and settle in Widnes, and take advantage of cheap lighting, and cheaper gas power for industrial undertakings. The whole community benefited by it. It would be a great injustice to the inhabitants to take away the profits of gas at an increased cost, in order to apply them to the relief of the general rates. In that case, they would be relieving the man who did not use gas at all. He agreed with the contention of Mr. Alderman Gibson, the Chairman of the Manchester Gas Committee—viz., that each department of a municipal corporation should work out its own salvation.

Mr. TEASDALE (Salford) said he was on the side of the ratepayers. Gas was for the benefit of a town. Ratepayers were in the position of the constituents of a private company, and ought to have the benefit of the undertaking. To get customers they must sell a commodity cheap in price and good in quality. In a corporation gas-works good profits should be made; and he ventured to think that if increased salaries were paid to gas officials and employees, the profits from gas consumption would be still greater. Higher salaries would increase the interest of all the workers in its production. As in a private company, so in a corporation, it would give them greater interest in the concern.

Mr. MERCER remarked that it was no encouragement for those in charge of an undertaking when all the profits were "collared" by someone else. The officials got no credit for it.

Mr. THORP (Manchester) said he was pleased that Mr. Teasdale had mentioned something on the other side of the question. There was a commercial, as well as an engineering, side of the case. The commercial man generally obtained a better "screw" than one in the engineering department. It was necessary for the student in gas enterprises to take up this question. The paper was rather a bold venture; and credit was due to Mr. Alsop and to his chief. The subject should be agitated. The ratepayers had it in their power to secure fresh Acts of Parliament or the repeal of old ones regulating gas profits. As Alderman Gibson advocated, let every department stand on its own bottom; and then town councillors would not go into fresh ventures without studying the cost. Why should gas pay for electricity? If the price of gas were raised to meet certain expenditure, it was only fair that it should be lowered when the opportunity occurred. As for the commercial side of the question, money could not be borrowed without paying for it; and if it was all paid back upon a particular undertaking, there was no hardship about it. Wherever the price of gas came down, a greater quantity was used. They should do all they could to make it as cheap as possible, and to encourage its use in all departments of the home and the manufactory, thereby purifying the atmosphere of the large towns, and benefiting the whole of the country.

Mr. GARLICK (Salford) said that, by Act of Parliament, they had to apportion a certain amount of the profits, after payment of all charges, to the relief of the rates. The question, however, of the price of gas and the disposal of profits was a subject which should be taken up by the different corporations. His views were on the side of the Widnes gas regulations. The matter should be explained to the ratepayers, and their interest aroused on this important subject.

Mr. ALSOP, in reply, commented upon the various anomalies which existed in dealing with consumers and non-consumers of gas, and consumers in outside districts drawing their supplies from a town of which they were not ratepayers. He also made some observations on the high price of coal, the borrowing power of gas committees, and the possibility of a new illuminant coming into vogue.

Mr. MERCER moved, and Mr. HOLLINGWORTH seconded, a vote of thanks to Mr. Alsop for his paper.

The vote was carried with applause; and Mr. ALSOP having acknowledged the compliment, the meeting terminated.

In another part of the "JOURNAL," reference is made to the victory of the Consolidated Gas Company of New York in the legal proceedings relating to the price of gas; and it is mentioned that the matter will be taken to the United States Supreme Court by the Public Service Commission—a body who have succeeded the Board on whose initiative the 80 c. rate was imposed. According to an announcement recently received from New York, the Commission have now resolved to investigate the affairs of the electric light and power companies of the city.

YORKSHIRE JUNIOR GAS ASSOCIATION.

A goodly gathering of members faced the PRESIDENT (Mr. J. H. HILL), when he took the chair at the meeting of the Association held last Saturday in the lecture theatre of the Bradford Technical College. At the close, all agreed that a most profitable and enjoyable afternoon had been spent in hearing the two papers that had been prepared for the occasion, and in freely discussing them, not only in formal speeches, but in a ready exchange of views in brief remarks, questions, and answers. These do not always admit of close reporting, but are, nevertheless, of great interest and value, especially in a Junior Association, and when the printed papers are not previously circulated for the preparation of criticism. In fact, the meeting closed not because comment was exhausted, but because the hour was getting late.

Mr. H. BUTTERFIELD, the Manager of the Silsden Gas-Works and Senior Vice-President of the Association, then read his paper.

HIGH-PRESSURE LIGHTING.

During the latter part of January, 1907, Silsden had the misfortune to have one of its most important mills destroyed by fire. Trade being brisk, the mill was quickly rebuilt, and is now in thorough working order. When the question of re-lighting confronted the occupants of the mill, they came to me for advice. This is what they said: "If you were called upon to light this mill as cheaply and efficiently as possible, what means would you employ?" To this I at once replied: "High-Pressure Gas." But upon reflection I came to the conclusion that I had made a mistake in advising the adoption of a scheme whereby their gas consumption would be lowered 20 to 25 per cent.—that is, if they employed similar units of light. So I set about devising some scheme whereby I could get them to use larger units of light. Next morning I made inquiries as to the production of goods in summer, as compared with the production during the lighting season; and I found that the output during the lighting season was 15 to 20 per cent. less, and the work turned out of an inferior quality. So I suggested that if more light could be had, it seemed to me that the production and the quality of the goods might be improved; and seeing that their charges for room and power were fixed, the better lighting of the premises would result in increasing the capacity of the plant. They fell in with my proposition, and decided to have more light instead of less gas.

The system they decided upon was Keith's. This system consists in increasing the normal pressure of the ordinary town gas supply by means of a machine called a compressor. The compressor can either be driven by water power derived from the ordinary street main, hot-air engine, electric motor, or by belting running from the shafting of the mill. The gas at the increased pressure—viz., 8 to 12 inches water-gauge—is then distributed in the ordinary manner; the gas-fitting being done carefully, to withstand the increased pressure. The burners used are Keith's, which are specially designed in order to obtain the highest efficiency from the gas. It is the increased pressure, in conjunction with the special burners, which enables complete combustion to be obtained. This is due to the increased velocity of the gas at the nozzle of the burner being capable of drawing in a larger proportion of air than is possible with low-pressure burners. The actual increase in efficiency is almost double—that is to say, one can get almost double the amount of light from a given quantity of gas than when used at the normal pressure in ordinary incandescent burners.

All the types and sizes of compressors are self-governing. In the power-driven machines the driving pulley is run at a constant speed, and the excess of gas which is compressed and not used is simply returned to the inlet of the machine by a form of return valve—thus obviating the slightest risk of any increase of pressure in the distributing pipes to the burners. High-pressure lighting has been largely adopted in Great Britain; there being in daily use considerably over 5000 installations. These comprise railway stations, sidings, docks, engineering works, foundries, mills, warehouses, factories, wholesale and retail shops, laundries and dye-works, public halls and markets, schools, &c. From this, it will be seen that the light can be universally used for practically every class of lighting work.

In London, there are some very important installations for public lighting. In Queen Victoria Street, Lower Thames Street, and round the Monument high-pressure lighting has been installed for some time; having displaced electric arc lamps. The actual annual saving runs into hundreds of pounds, with at the same time a greatly increased light.

In foundries, engineering works, and public halls, it is usual to fix units of fairly large candle power well above the floor level, and in some cases in the roof, and so obtaining a brilliant, and yet at the same time well distributed, light. Lamps of various styles for different classes of buildings are available; but there is no difficulty in adapting the burner to ornamental fittings. The claim for Keith's system is 30-candle power per cubic foot of gas consumed per hour. To facilitate comparison, I give the following example: Area of shop, 10,000 superficial feet; light standard, 1 candle per foot floor area; gas consumption, 333 cubic feet per hour; cost, with gas at 3s. 4d. per 1000 feet, 1s. 1·33d. per hour. The cost remains constant irrespective of the unit of light employed; but 150 and 300 candle powers are found most suitable. For small units of light the inverted burner seems well adapted, and forms an ideal fitting for use in factories where small machine work is carried on—such as clothing factories, where a large number of sewing machines are used, and 45 or 90 candle power burners would be ample, and the gas consumption would be 1½ and 3 cubic feet respectively.

The high-pressure system at Silsden is used for lighting a weaving shed. The plant employed is as follows: The compressing plant consists of a Keith "A" rotary blower to supply 500 cubic feet per hour at 450 revolutions per minute. It is driven from the mill shafting; the pulley on the shafting being 14 inches in diameter, having a speed of 118 revolutions per minute, and the drum on the blower being 3½ inches in diameter, giving a speed to the blower of 472 revolutions per minute, and maintaining a pressure of 8 inches in the supply pipes. The lighting plant consists of 89 lamps, 150-candle power, fitted with a very effective anti-vibrator; each burner having an electric ignition cock, climbing bye-pass, and enamelled reflector. The electric battery consists of four Leclanche cells, with sparking coil and switch. The whole plant, as far as can be seen at present, is strongly made and works very satisfactorily.

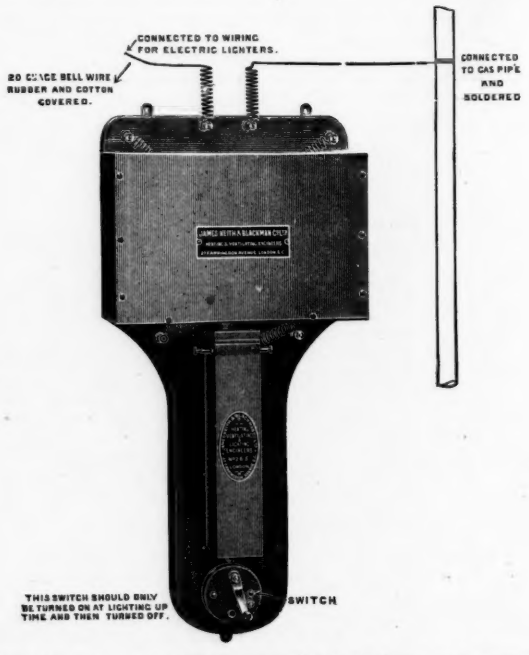
We now come to the most important part—that is, the benefits to be derived from a high-pressure system similar to the one described.

Increased Candle Power per Cubic Foot of Gas Consumed.

	No. of Burners.	Candle Power.	Total Candles.	Consumption Per Hour. Cubic Feet.	Candles per Cubic Foot of Gas.	
High-Pressure	89 ..	150 ..	13,300 ..	410 ..	32·43	New Style.
Low-Pressure No. 4 Kerns	95 ..	80 ..	7,600 ..	400 ..	19·00	Old Style.

From the above table, it will be seen that there is a clear gain of 13·43 candles per cubic foot of gas consumed. It will be noticed that the candles per cubic foot of gas consumed are more than guaranteed by the makers—viz., 30 candles; but the above figures are actual, and not assumed.

Small Economies per Light.—In mills where low-pressure is employed, it is customary for someone to be at work lighting up some ten minutes before starting time. As a rule all the lights are turned on at once by the meter tap, and turned off in a similar manner when lighting ceases. It will, therefore, be easily understood how the pipes become filled with air, and some time elapses before this can be driven out, causing a very objectionable smell; and from the time the gas is turned on at the meter to the time of the mill starting, is so much gas wasted. In the case under consideration, the mill is lighted eleven times per week, and gas is wasted for ten minutes each time, equalling 110 minutes per week.


CONNECTED TO WIRING FOR ELECTRIC LIGHTERS.
20 ounce BELL WIRE RUBBER AND COTTON COVERED.
CONNECTED TO GAS PIPE AND SOLDERED
THIS SWITCH SHOULD ONLY BE TURNED ON AT LIGHTING UP TIME AND THEN TURNED OFF.
SWITCH

Therefore, if in 60 minutes 400 cubic feet of gas are consumed, 733 cubic feet will be used in 110 minutes, equalling, at 3s. 4d. per 1000 feet, about 2s. 5d. per week. Again, assuming that three or four weavers are late or absent, under the old system their lights were turned on and lighted; and if the weavers turned up 10 or 15 minutes late, so much gas was wasted. This seems a small thing to mention; but it is the picking up of these small economies that justifies the installing of the electric ignition cock. Each weaver has complete control over his or her burner, and

no waste occurs; also the electric igniter does away with the necessity of carrying naked lights. Though much cannot be said about it, its advantages are obvious.

Mantle Account.—Although I have included mantles among the advantages to be derived, such is not actually the case, for one expects that when high pressure is employed the mantle account will also be high. But so far, with the installation under observation, no difference has been noticed. This, I think, is a very important point.

Ease with which the Compressor can be Handled.—There are no complicated parts about the compressor, the lubrication is simple and practically automatic, and the bye-pass valve is just the ordinary mushroom valve prepared to receive weights or otherwise as required, and works equally well with one light or with the maximum number of lights. The compressor is fitted with fast and loose pulleys, and requires no skilled attention. Another point is that, when the mill stops, there is still sufficient light to enable the workpeople to see their way about. This, I believe, in some systems is a great drawback, owing to the light failing altogether when the compressor stops.

There is only one drawback to set against these good things. As is well known, the air in weaving sheds is always charged with dust and fluffy material. This causes the illuminating power of all incandescent burners to deteriorate very rapidly, which is somewhat aggravated by high-pressure burners—the fluffy material being more readily drawn in by the excessive vacuum created. Thus the gauze at the burner-head becomes choked, and the lighting efficiency of the burner decreases rapidly. But the simplicity with which the burners can be cleaned without any risk of damage to the mantles forms a strong point in their favour for use in weaving mills. The operation of cleaning a burner occupies no more than a minute after a little practice. This is undertaken weekly; and with careful attention no loss of efficiency need be feared—the burners resuming almost their original brilliancy. Of course, this choking of the burners does not occur in all trades; and I have no hesitation in saying that the results obtained justify the capital expenditure. Although at present I cannot produce any figures to show increased production, I am assured by those responsible that an increase is taking place.

[Mr. Butterfield had one of the 150-candle power lamps, with electric ignition cock, battery, &c., installed over the reading-desk; and although he had no compressor, and so could not show the ordinary light, and therefore refrained from even putting on a mantle, the ignition arrangements were demonstrated and afterwards examined by many present. This lamp was also provided with a cage of copper gauze of very fine mesh all round the lower part of the burner where the air inlets are situated; and the author explained that this had proved of great value in straining off the particles of fluffy material that in a weaving shed so readily obstruct the burners. In fact, instead of needing weekly cleaning, once every three weeks had proved sufficient.]

The PRESIDENT, in throwing the meeting open for the discussion of the paper, said that they did well to applaud the reader, for he had shown a worthy and commendable spirit in stepping into the breach and volunteering to do what he could on short notice. He trusted that such a spirit and such a willingness might more and more characterize their members; and such service was always appreciated. They looked forward with confidence to Mr. Butterfield's occupancy of the President's position. The paper left room for questions and criticism; and they could not better show their appreciation of it than by freely handling it in a spirit of friendliness and desire for mutual helpfulness.

Mr. BUTTERFIELD, in reply to a series of questions put by Mr. G. W. Fligg, stated that he had not at present a full statement of the costs in the present instance; but in a neighbouring town a similar installation of 60 lights, each of 150-candle power, with a water-driven compressor, cost £78, which included all fittings and electrical ignition arrangements. In this case, flat-flame burners had previously been in use; and instead of 97,000 cubic feet being consumed in the half year, only 44,000 feet had been needed—a saving of 55 per cent. The weavers greatly enjoyed the new light, felt no discomfort from it, and an increase in production of from 10 to 15 per cent. had resulted from the better working conditions. The installation at Silsden had been put in at the mill-owners' expense. In giving 32½ candles per cubic foot as the light now obtained, he admitted that the figures were lower than sometimes given. They were decidedly on the "safe side," so as not to cause any injustice in making the comparison with the old arrangements. The old services were utilized for the new installation; and he now had none of the former complaints about deficiency of pressure.

The PRESIDENT commented on Mr. Butterfield's statement that he endeavoured to counteract what would have been a lessened consumption of gas by recommending the use of larger units of lights. His practice at York now was not to secure the larger units, but a greater number of smaller ones combined with a better and more equable diffusion of light. He wondered whether the weavers' increased production in the summer months was all to be attributed to better light, and whether greater comfort and warmth might not be mainly responsible for it. He was rather surprised at the lowness of the figures given for a No. 4 Kern burner. He should have stated their efficiency at 25 candles per cubic foot—thus giving a total candle power of nearly 10,000, rather than the 7600 Mr. Butterfield had given. He went very fully into the comparison of the high-pressure system and the Lucas self-intensifying lamps in connection with an exhibition they had some time previously. He could not just then lay his hands on the details of his tests, and the exact figures resulting from them; but their general purport was to show that, after allowing for the initial cost of the compressor, &c., interest on this, depreciation, water costs, &c., any margin of advantage was insufficient to give a decided preference for the high-pressure system. The actual result was that the Corporation Committee insisted on the replacement of the high-pressure lights by self-intensifying ones. The reference to the fluffy material drawn in by the vacuum induced at the air-holes reminded him that he had lately been rung up on the telephone by a consumer who wanted to know if he could lend him a vacuum register for measuring the vacuum at his burners. When asked what kind of vacuum he meant, the consumer could only say that he understood that there was a vacuum somewhere about the burner, and he wanted to measure it. "In any case, a vacuum was a vacuum, wasn't it; and were not all alike?" They suppressed him by asking him first to find the vacuum.

Mr. BUTTERFIELD considered he was justified in attributing the increased production of work to the better light of summer rather than to increased warmth and comfort, inasmuch as the shed was always kept very comfortably warm in winter. They had at present two similar sheds side by side—one lighted by Kern burners and the other, as described, by the "Keith" light; and the difference in the general effect was most marked even to the a casual and inexperienced onlooker.

Mr. HILL deprecated drawing conclusions from such rough and ready testing, and reiterated his strong adherence to smaller units of light in greater number and judiciously distributed.

Mr. BUTTERFIELD, in reply to questions from several members, stated that the lights were placed between the looms—one light for two looms. The four Leclanché cells sufficed for the electric ignition of the burners of the whole shed. No special provision was made for a supply of gas at ordinary pressure at times when the compressor was not working. He found that enough gas could slip round the blades of the compressor to give the workpeople light enough to make their way safely out of the shed.

Mr. E. J. SUTCLIFFE, Superintendent of the Birkshall Gas-Works of the Bradford Corporation, next read his paper on

THE COMPARATIVE VALUATION OF GAS COALS.

The unsettled state of the coal market during the year 1907 must have caused great anxiety to gas engineers throughout the country; and with the values, or rather the prices, of coals increasing up to 3s. 6d. per ton (a rise of 33 per cent. in many cases) at the time when most contracts were being placed, the whole gas industry itself must have experienced a depressing influence. Most managers would no doubt hesitate for a time before throwing over coals which they had worked with satisfaction for years, in favour of lower-priced ones of which they knew nothing. After satisfying themselves, by tests and analyses, of the capabilities of these cheaper coals, some method of comparison with the known descriptions must have been used in order to ascertain their proper monetary value; for the valuation of a gas coal involves something considerably more than a question of mere cost per ton. Several methods of making comparative valuations of gas coals are in use; and some of these I purpose discussing, pointing out what I consider to be the weak points in each, and then stating a method which I think gives a fairer comparison than the others. I wish at the outset to say that I make no claim to originality in anything that I may bring before you.

It has been said that: "The utility of any arithmetical or geometrical plan for representing the value of a coal must obviously turn upon the accuracy of the data that are used as the starting points. Once right in regard to these, it is only a matter of skill and accuracy on the part of the investigator to work out the value of every sample according to one common basis, and thus to indicate the comparative value of each." This is not altogether correct, although I agree with the first sentence entirely. Later, I hope to show that, using the same data as starting points, different engineers have adopted different bases upon which their comparisons are calculated, and thereby arrive at different values for the same coals.

The first method which I wish to notice is that which has been described in Newbigging's Handbook, where the compiler seeks to establish a value for a coal yielding 9700 cubic feet of 16¾-candle power gas, 14 cwt. of coke, 9 gallons of tar, and 20 gallons of liquor, by comparing it with another coal which yields 10,600 cubic feet of 17½-candle gas, 13½ cwt. of coke, 10 gallons of tar, and 22 gallons of liquor. and costing 12s. 6d. per ton. Mr. Newbigging says, "Attach approximate or actual market prices to the sperm pounds as ascertained and to the several residual products, cast up the various items, and compare them by the ordinary rule of proportion." He then proceeds to compare them as follows:—

No. 1.—*Costing 12s. 6d. per ton.*

10,600 cubic feet, 17½-candle power gas = 636 lbs. of sperm at 1s.	£31	16	0
13½ cwt. of coke, at 5d.	0	5	7½
10 gallons of tar, at 1¼d.	0	1	0½
22 gallons of liquor, at 1d.	0	1	10
	£32	4	6

No. 2.

	£	s.	d.
9700 cubic feet 16¾-candle power gas = 557 lbs. of sperm at 1s.	27	17	0
14 cwt. of coke, at 5d.	0	5	10
9 gallons of tar, 1¼d.	0	0	11¼
20 gallons of liquor, at 1d.	0	1	8
	£28	5	5¼

"Assuming that No. 1 is 12s. 6d. per ton, the relative value of No. 2 will be found as follows: As £32 4s. 6d.: £28 5s. 5¼d.:: 12s. 6d.: 10s. 11½d. the value per ton of No. 2."

If Mr. Newbigging had held to what he said in the first quotation above—*i.e.*, attach approximate or actual market prices to the sperm pounds and to the several residual products—this method would have been fairly comparative. But he did not do so. Is £31 16s. either the actual or the approximate market price of 10,600 cubic feet of 17½-candle gas? The fact that it is calculated from its sperm value does not increase its value to the gas maker. It is easy to imagine a case in which the enormous value thus given to the gas is sufficient to neutralize the whole of the residual products. For instance, say a coal at 12s. 6d. gives 10,500 cubic feet of 16-candle power gas, and the coke, tar, and liquor are of no value. 10,500 cubic feet of 16-candle power gas = 576 lbs. of sperm at 1s., £28 16. Another coal gives (say) 10,300 cubic feet of 16-candle power gas equals—

	£	s.	d.
565 lbs. of sperm at 1s.	28	5	0
14 cwt. of coke at 5d.	0	5	10
14 gallons of tar at 1¼d.	0	1	5½
18 gallons of liquor at 1d.	0	1	6
	£28	13	9½

£28 16s.: £28 13s. 9½d :: 12s. 6d.: 12s. 5·4d. the value of coal No. 2. But is No. 1 the better coal? Are 200 cubic feet of 16-candle power gas of greater value to the maker than 14 cwt. of coke, 14 gallons of tar, and 18 gallons of liquor? I think not; and I do not consider that Mr. Newbigging would claim a greater value for the gas. In my opinion, the fictitious value given to the gas destroys the ratio altogether.

It may be said that I am presumptuous and treading on dangerous ground in running counter to such an authority as Mr. Newbigging. But I am sure that Mr. Newbigging himself would be the last to blame me for honestly holding opinions different from those he held. When addressing us 15 months ago, he said:* "Do not unreservedly accept any man's *obiter dicta*—neither mine nor those of anyone else. Put them through the sieve of your intelligence. Bring to bear upon them your practical experience and thought and knowledge, as far as these enable you to form a judgment." Although Mr. Newbigging's method of valuation can scarcely be called an *obiter dictum*, still I am sure that he will not object to my honest criticism of it.

Paterson, in his work "Notes on the Lithology of Gas Coals," adopts a different method, and also gives a very different value to a pound of sperm from that of Mr. Newbigging, He states (p. 12): "I may further add, in connection with these tabulated weights (pounds of sperm, as given in his analyses of coals), that 0·25d. per pound will fairly represent the present money value of the coal at the pit. Thus a coal containing, say, 600 lbs. of illuminating matter, is worth 600 × 0·25 ÷ by 12 = 12s. 6d. per ton. In the same way the value of one may be compared with that of another; and the arbitrary value of one farthing per pound of illuminating matter, I have here assumed may be altered to any other unit and applied to the series throughout." This was the value he gave the pound of sperm in 1872; in 1882 he reduced it to 0·153d.; and in 1887 he brought it down to 0·144d. For cannel, his co efficient in 1887 was 0·20d. In both cases, he said, it might be regarded as giving a close approximation of their true values; but he does not state how it was that he arrived at his co-efficients.

I presume he would do it by taking a well-known coal as his standard, and calculate the value from its current market price and the weight of the illuminating matter as ascertained by experiment. This, however, would be a constantly varying quantity, and the method can scarcely be regarded as practicable today. A misleading feature of the method is that it altogether ignores the values of the products other than gas. In 1872, it might have been possible to neglect these things; but in the competitive days of 1908 their worth must be taken into consideration. Applying Mr. Paterson's latest value of the pound sperm to the two coals previously considered, their values at the pit would be:—

No. 1. $\frac{636 \times 0{\cdot}144}{12} = 7s.\ 7{\cdot}58d.$ No. 2. $\frac{557 \times 0{\cdot}144}{12} = 6s.\ 8{\cdot}21d.$

If No. 1 cost 12s. 6d. at the works, the comparative value of No. 2 on this basis would be—

$\frac{6s.\ 8{\cdot}21d.}{7s.\ 7{\cdot}58d.} \times 12s.\ 6d. = 10s.\ 11{\cdot}3d.$, which agrees well with Mr. Newbigging's valuation of it.

Another method suggested is to take the gas as being of the same candle power as that sold in the town; the make per ton to give this quality being calculated by Farmer's rule in the usual way. Say the gas sent out is of 18-candle power, and is sold at 2s. 3d. per 1000 cubic feet, No. 1 coal would give—

$\frac{10{,}600 \times 17\frac{3}{4}}{18} = 10{,}453$ cubic feet of 18-candle gas.

	£	s.	d.
10,453 cubic feet of 18-candle gas at 2s. 3d.	1	3	6¼
Residuals as before	0	8	6
	£1	12	0¼

No. 2 coal would give—

$\frac{9700 \times 16\frac{3}{4}}{18} = 9026$ cubic feet of 18-candle gas.

	£	s.	d.
9026 cubic feet of 18-candle gas at 2s. 3d.	1	0	3¾
Residuals as before	0	8	5¼
	£1	8	9

£1 12s. 0¼d.: £1 8s. 9d.:: 12s. 6d.: 11s. 2·7d.

Here the No. 2 coal is valued at 11s. 2·7d. per ton. This I believe to be a better method than either of those previously referred to; but its weakness lies in the fact that the rule by which the make of low-quality gas is calculated into a make of higher quality gas is only approximate, and that within limits. Paterson, in his work already mentioned, states that Farmer's rule is not capable of universal application: "If we take a coal possessed of high coking properties, it requires that the temperature be materially increased in order that the lighter liquid hydrocarbons may be converted into permanent illuminating gases, instead of being carried off in combination with the tar. With coals of this description—such as are presented by several of those in South Yorkshire—I have uniformly found that reduction in quantity is accompanied with reduction in quality, and *vice versâ*." (*Op. cit.*, p. 12.) This being the case, the matter has a very practical bearing for many of our members, as South Yorkshire coals are in very common use in our district.

In making comparative valuations of gas coals, it must be remembered that the cost of the gas is largely dependent upon the weight of coal handled, irrespective of the yield of gas per ton. Coal unloading, carbonizing wages, repairs of retorts, &c., depend almost entirely upon the weight of coal carbonized; and these are items which are entirely ignored in the methods already noticed. Take two coals, one giving 11,200 cubic feet and costing 12s. per ton, and another giving 9500 feet and costing 9s. 6d.; the quality of the gas being the same in each case. At the first glance, it might be supposed that the lower priced coal was the cheaper; but if we add the working charges to the cost of the coal in each case, we shall find that it is not so. If we take these charges to amount to (say) 5s. 6d. per ton on an annual make of 150 million cubic feet, we shall find the total costs to work out as follows:—

With the 12s. od coal, 13,393 tons would be required.
" " 9s. 6d. " 15,789 " " " "

	£	s.	d.		£	s.	d.
13,393 tons at 12s. od.	8,035	16	0	15,789 tons at 9s. 6d.	7,499	15	6
" " " 5s. 6d.	3,683	1	6	" " " 5s. 6d.	4,341	19	6
	£11,718	17	6		£11,841	15	0

It must be evident from this that these charges ought to be taken into account when making comparative valuations of coals, or misleading results may be arrived at.

An improvement upon the preceding methods, because it takes the factors just mentioned partially into consideration, consists in obtaining the number of candle-feet given per ton, by multiplying the make per ton by the candle power, and pricing this out at the approximate net cost of the gas. If 18 candle-power gas costs 1s. 6d. per 1000 cubic feet in the holders, the price would be 1d. per 1000 foot-candles. Applying this principle to the same two coals, we have:—

No. 1—
10,600 cubic feet of 17½-candle gas: 185·5 thousand foot-candles.

	£	s.	d.
$\frac{10{,}600 \times 17{\cdot}5}{1000} = 185{\cdot}5$ at 1d.		15	5½
Residuals as before		8	6
	£1	3	11½

No. 2—
9700 cubic feet of 16¾-candle gas.

	£	s.	d.
$\frac{9700 \times 16{\cdot}75}{1000} = 162{\cdot}5$ at 1d.		13	6½
Residuals as before		8	5¾
	£1	1	11¾

$\frac{£1\ 1s.\ 11\frac{3}{4}d.}{£1\ 3s.\ 11\frac{1}{2}d.} \times 12s.\ 6d. = 11s.\ 5{\cdot}6d.$ as value of coal No. 2.

Very little fault can be found with this method. But I think it would be better to calculate the value of the gas from the average price realized rather than from its cost in the holders, and also to reckon the value of the other products from the average prices realized, rather than take them at the current market rates, for the expenses incurred in handling these commodities ought certainly to be taken into account and deducted from their full value; and this would alter the proportional values of the coals.

The method which I prefer is to take the price of the gas as the average price realized for it in the town, and from this calculate the value of the pound sperm. For example, if the town gas

* "Transactions, Yorkshire Junior Gas Association," 1906-7, p. 7.

be of 17½-candle power, and an average price of 2s. 6d. per 1000 cubic feet, be realized for it, then each 1000 cubic feet would be an equivalent of 60 lbs. of sperm— $\frac{1000 \times 17\frac{1}{2} \times 120}{5 \times 7000} = 60$; and the price per pound of sperm at the actual market rate would be $\frac{30}{60} = \frac{1}{2}$d. When Mr. Edwards's valuable paper on "The Testing and Valuation of Gas Coals" was discussed by this Association, many of the members dissented from the idea of deducting the unaccounted-for gas, arguing that it had nothing to do with the valuation of the coal. At the time I was disposed to agree with them. Upon further consideration, however, I think that, if the gas be valued in the way I have just described, it is necessary that this deduction should be made; for the quantity of gas consumed is the quantity which is of value to the producer, as it is upon that only that profit is made.

The residuals ought to be valued in the same way. The coke saleable—that is, the make, less that used for carbonizing, &c.)—should be charged, not at the current rate per ton, but at the amount realized per ton for it, or, in other words, at the amount at which it is sold, less all the expenses incurred in handling it, &c. Tar and liquor might be valued in the same manner. But as the expenses incurred upon these products are almost infinitesimal, the prices at which they are sold might be taken, for any deduction on this account would not influence the ratio to any appreciable extent. Calculating in this way, and taking the unaccounted-for gas at 5 per cent., 3 cwt. coke used for firing, and 7s. 6d. as the price realized per ton for coke, I should estimate the value of Mr. Newbigging's coal as follows:—

No. 1.—*Costing 12s. 6d. per Ton.*

10,600 cubic feet, less 5 per cent.
530

10,070 cubic feet of 17½-candle gas.
$\frac{10,070 \times 17{\cdot}5 \times 120}{5 \times 7000} = 604$ lbs. sperm.

	£	s.	d.
604 lbs. of sperm at ½d.	1	5	2
13½ − 3 = 10½ cwt. of coke at 4½d.		3	11¼
10 gallons of tar at 1d.			10
22 gallons of liquor at ⅛d.		1	2¾
	£1	11	2

No. 2.—*Costing X per Ton.*

9700 cubic feet, less 5 per cent.
485

9215 cubic feet of 16¾-candle gas.
$\frac{9215 \times 16{\cdot}75 \times 120}{5 \times 7000} = 529$ lbs. of sperm.

	£	s.	d.
529 lbs. of sperm at ½d.	1	2	0½
14 − 3 = 11 cwt. of coke at 4½d.		4	1½
9 gallons of tar at 1d.			9
20 gallons of liquor at ⅛d.		1	1¼
	£1	8	0¼

£1 11s. 2d.: £1 8s. 0¼d.:: 12s. 6d.: 11s. 2·9d.

Therefore, coal No. 2 is worth 11s. 2·9d. per ton, compared with No. 1 at 12s. 6d.

I think this method of valuation the fairest of those described, because it takes every item into consideration. The value of the gas is not what it costs in the holders, but what it will realize when distributed in the proper market, just as is that of any other commodity in the commercial world. As the price of gas is calculated from what it realizes at the point of combustion, all the charges incurred up to that point must be taken into consideration. Hence I believe Mr. Edwards was right in making a deduction for unaccounted-for gas. The same reasoning applies to the other products of the distillation of the coal.

Using the same data as starting points, we have by the five methods enumerated, five different values given to the same coal —10s. 11½d., 10s. 11·3d., 11s. 2·7d., 11s. 5·6d., and 11s. 2·9d. respectively, with an extreme difference of 6·3d. It therefore appears as though something more than skill and accuracy is required in order that the valuation may be true—the common basis has yet to be established. It is with the idea of establishing a common basis upon which these valuations may be made that I have troubled you on the subject; and I shall be pleased to have your opinions upon it.

The PRESIDENT, in opening the discussion, thanked Mr. Sutcliffe for his thorough and exhaustive paper. It was not the first or second that he had favoured them with. He never spared himself in his efforts on behalf of the Association; and the members owed as much to him probably as to anyone. He was much struck with Mr. Newbigging's use of 1s. per pound as a price for sperm. It was difficult to realize the origin of such an extraordinary figure, unless as an actual price of sperm candles. It appeared to give a value of about 60s. per 1000 cubic feet of gas. In spite of the great fulness of Mr. Sutcliffe's calculations, he really thought it was incumbent to take into calculation the cost of enrichment, when this was necessary. He could not see whence Mr. Paterson's allowance of ¼d. per pound for sperm was derived, though it seemed to give a value to gas coal nearer the actual one than some other methods.

Mr. CLEGG asked whether no notice was to be taken of the amount of ash and sulphur in the coal. These varied in coals, and probably would in the coals actually being tested; and surely the total amount of sulphur would affect the cost of purification. Would this be almost too insignificant to take into account, or had it been allowed for?

Mr. HILL also referred to this point, stating that one coal they began using had to be discontinued because the slaty material in the coke made it almost impossible to sell it.

Mr. C. TOWNSEND pointed out how greatly coals differed in the amount and behaviour of the clinker they produced when their coke was used in the furnace. Heats were reduced, and so the correct make was not obtained. Besides, carbonizing wages would be affected from the need of more frequent clinkering.

Mr. FLIGG quoted a similar experience with their inclined retorts at Dewsbury, where the make dropped by 60,000 cubic feet a day from the cause. In Mr. Sutcliffe's calculations, he was assuming certain prices for residuals; but these prices were liable to rapid and serious fluctuations, and how could he make his calculations unless, perhaps, from the average prices of the previous year.

Mr. CRANFIELD said that he wondered whether great elaboration in a system of testing and comparing coals was not tending to get away both from actuality and utility. Some men were literally obsessed by statistics—not that for a moment he imagined Mr. Sutcliffe was one of such—they compiled elaborate tables, often with items having no immediate or clearly understood bearing on the case, sometimes with erroneously-ascertained figures, and often with no uniting and simplifying scheme to focus their wealth of information into a serviceable formula or summary. Coal valuation and comparison were eminently subjects where an ideal system would have to take into account a large number of factors, some of which—and important ones—could only be ascertained in actual continuous working on the large scale, and even then expressed with difficulty in precise figures. He was curious to know how far actual works practice used these elaborate calculations and how exact the tests were which were taken. At small works, testing could be carried out on the whole plant then in use, and so under actual working conditions; but these works were just the ones where photometric and other apparatus and tests left much to be desired on the score of accuracy and reliability. Larger works, on the other hand, would more often rely on a small experimental plant, which might give results comparable with one another in most respects, but sufficiently differing from those obtained in actual practice to vitiate a good deal of the refinement of calculation sometimes recommended. It was like carrying calculations out to several decimal places when the whole numbers were not wholly reliable. He deprecated too rigid and elaborate a scheme. Theoretically, it was all right to allow for unaccounted-for gas, &c.; but were not such items as these practically too minute to matter, especially if the other observations only noticed on continuous working were omitted? After all, did the quantities of tar, coke, and liquor matter so very materially in determining the choice of a coal, especially if no notice was taken of the quality of the coke and the liquor was only expressed in gallons and Twaddel strength? Provided the yield of gas and its candle power were accurately determined, what objection could, in most cases, be taken to simply calculating the sperm equivalent of a ton of coals, and dividing this by the pence charged for a ton (thus getting the pounds of sperm bought for 1d.), or dividing the price of a ton by its sperm equivalent (thus getting the price of 1 lb. of sperm)? This was simple, easily grasped, and truly comparative as far as it went; while any addition or correction needed would depend far more vitally upon the impressions of previous experience of the coal—difficult to express in figures—than upon any calculations about residuals. All the same, he supported Mr. Sutcliffe's contention that such a consideration as the cost of handling the coal must not be lost sight of in comparing two coals of seriously differing yield of gas per ton. He should be very remiss if he did not express his appreciation of Mr. Sutcliffe's valuable paper, which had already proved its value as provocative of discussion and thought. Though not of immediate interest perhaps, nor arising out of the paper, he thought that it should not entirely be overlooked that eventually much greater attention might be devoted to calorific data in selecting coals. He invited the members' attention to the interest attaching to investigations and comparison of the number of B.Th.U.'s to be obtained from a ton of coal and from the gas derived from that ton. Such data should be available when dealing with gas heating, and might lead to some change of opinion upon the price to be charged for gas used for heating purposes. He knew, of course, it was difficult to compare the two cases fairly, since while gas was completely barred, coal was by no means fully utilized in a house-fire; and the loss of heat up the chimney was not the same in both cases. Yet the Association would welcome any results that any members might obtain in actual investigation.

Mr. ROBERTS and Mr. BUTTERFIELD championed small works practice as against the remarks of the last speaker, pointing out how completely their testing gave actual working results and enabled large-scale working to be fully studied, and so all the necessary factors obtained for coming to a right decision.

Mr. LEE also twitted the same speaker with his conservatism and failure to appreciate the efforts of those who, like the writer of the paper, were endeavouring to introduce newer and more improved methods into gas-works practice.

Other speakers followed on the same lines, to whom Mr. Cranfield replied that not a single one of them had met his request for

a statement of how they drew up a comparison of the coals from the tests they declared they could make so efficiently on small gas-works.

Mr. EDWARDS replied to previous questions as to how the quoted sperm values given by Mr. Paterson had been obtained. They were clearly the pence per ton divided by the pounds of sperm. Mr. Sutcliffe pointed out the difficulty of basing a calculation on the current market price of coal, as it was constantly varying. Constant factors could not be obtained and, indeed, were not necessary; but Mr. Sutcliffe's suggested scheme erred in just this, that it sought to make some of its items absolute and not comparative. In comparing a number of samples that had been tested, it was easy to calculate an average or standard price, and then note the net excess or deficiency of each specimen, and, if necessary, bring in another factor showing the position of its residuals compared with the average or standard. Certain phases of quality could not be touched or allowed for in £ *s. d.* One must take into account the size of the works, &c.—*e.g.*, a small works might use only one coal, and so the quality of its coke was an important item to take into consideration, while a large works used fifty coals, and all the coke would be mixed together and sold as coke at one price; so that the qualities of the separate cokes made no appreciable difference. Mr. Sutcliffe had emphasized the need of taking into consideration the cost of handling the extra weight of coal required in the case of one coal having a less yield of gas than another. This was self-evident; and yet he omitted to use this correction to the full in his calculations. In his fourth calculation, he knew the approximate cost from his last year's working (say) of No. 1 coal. Supposing he then had to change to No. 2 coal, of which he must use more to get the same volume of gas, the cost into the holder was now more, and yet the same figure was used—thus invalidating the method. In the last calculation, the same vital error existed, for a fixed charge would not apply.

Mr. SUTCLIFFE said that he had expected to be "slated;" and had been gratified by the interest the paper had awakened. His great aim had been, bearing in mind how naturally any one in doubt would turn to Mr. Newbigging's "Handbook," to call attention to the obsolete method there indicated. Some time ago, before the fifth edition was published, he called Mr. Newbigging's attention to the subject. In reply, Mr. Newbigging promised to look further into the matter, but was inclined to think the method satisfactory and valid as a means of comparison. As it still stood unchanged in the seventh edition, he had thought he might venture to call general attention to it. He quite agreed with much of Mr. Edwards's criticisms, though he did not claim the fourth calculation as his own. Since writing the paper, he had noticed that in the earlier calculations he had taken Mr. Newbigging's prices for tar and liquor, and in the last he had taken a more recent price; strictly, he ought to have adhered to the original prices throughout. In reply to Mr. Fligg's remarks about the varying prices of tar and liquor in the year for which the tests were being taken, he would point out that in any case it would act in the same way for all the coals, and would not interfere with the comparative tests.

Mr. EDWARDS, in reply to further questions, repeated and expanded his previous suggestion for making a comparison of coals. First test all the samples and collect the results. Then find the average value of the sperm based on the present tenders, or last year's, whichever was available. From these calculate the excess value or deficiency of each specimen. Make similar calculations for the residuals and get the net total of the two results. A special note should be made of any coal that had been proved to yield a very good coke. Usually, however, it would be found that the coals yielding poor cokes had been already ruled out by this process.

Mr. LEE agreed with this scheme in the main, but pointed out that in a great coke-selling centre like Sheffield it was absolutely necessary also to tabulate and allow for the percentage of ash in the coke.

Hearty votes of thanks to the readers of the papers were awarded on the motion of Mr. SHEPHERD, seconded by Mr. M'NAB; and the proceedings ended.

We have received the "Local Government Annual and Official Directory" for 1908. This is the seventeenth year of publication, and the character of the book has become generally known. The contents are officially corrected, and therefore they should be reliable. The particulars relating to the Metropolitan Water Board now include the new scale of charges to come into operation on the 1st of April next. The "Annual" is edited by Mr. S. Edgecumbe Rogers, and is published at No. 27A, Farringdon Street, E.C., at the price of 1s. 6d.

The forthcoming congress of the Royal Institute of Public Health, which is to be held at Buxton from the 18th to 24th of July, under the presidency of the Right Hon. Victor C. W. Cavendish, M.P., will afford an opportunity for bringing under notice the latest examples of gas, water, and sanitary equipments and appliances. The exhibition, which will be open to the public, will be held in the fine corridor of the Buxton Pavilion, in which building the inaugural reception will be held. The Hon. Exhibition Secretaries are Mr. J. W. Souden and Mr. W. J. Leeming, Electricity Works, Buxton.

SCOTTISH JUNIOR GAS ASSOCIATION.

EASTERN DISTRICT.

A Quarterly Meeting of the Eastern District Section of the Association was held in the Heriot-Watt College, Edinburgh, on Saturday evening—the PRESIDENT (Mr. D. Bisset, of Grauton) in the chair.

In opening the proceedings, the PRESIDENT announced that six new members had joined since the session started; and the Council considered this very encouraging.

THE CONSTRUCTION OF GAS-WORKS.

Mr. A. MORTON FYFFE, A.M.I.Mech.E., Assistant-Engineer at the Dundee Corporation Gas-Works, and Vice-President of the Association, read a paper on the above subject. The title of the paper included "The Re-Construction of Gas-Works;" but, on account of want of time, this portion of the communication was held over.

Mr. Fyffe, in the course of his paper, said the subject of the "Construction and Re-Construction of Gas-Works" was one which was sometimes not accorded so prominent a place in the list of the manifold duties which were embraced by the term "Gas Engineering" as it really required. Sufficient importance was not always given to the fact that to a very great extent the "working costs" and the "general efficiency" of the undertaking were dependent upon the first construction of the works—that was to say, on the selection of the site and of the type, arrangement, and capacity of the plant to be placed at the disposal of the management. Time given to the careful planning of all these in the most minute detail was indeed well spent. It was not a case of simply erecting gas-works, and then setting about to see how they could best be worked efficiently and economically; it was too late for that when the works were completed. The aim of the designing engineer should be to make it possible to manufacture gas in the works, when erected, at the least possible cost; and it should be borne in mind that the objects of the undertaking included the following: (*a*) To supply light, heat, and power over a given area; (*b*) to supply this light, heat, and power at such a rate that it would be to the advantage of the population to utilize it for the three purposes; (*c*) to ensure the financial success of the concern; and (*d*) to do all these in the simplest and most effective manner possible.

The first part of the undertaking was the choice of a site; and in fixing this, a great many points required to be taken into consideration, among which were the following: (1) Railway facilities, and, if possible, shipping facilities, so that competition for freight might be obtained; (2) level of site, as bearing on the question of pressure over the area of distribution; (3) nature of soil and subsoil, as affecting foundations; (4) the possibility of having a natural, or at least an easily adaptable, water supply; (5) the question of having or reserving spare ground for reasonable extension due to future development; and (6) the question of being near suitable housing accommodation for the use of the employees. Members of the Association who had to do with works where it was necessary to cart in the primary materials and cart out the bye-products and refuse, knew how this added to the working costs; and he had no doubt they often dreamt of what could be attained if they could have their materials directly delivered into, and despatched from, the works. A gas undertaking with an annual demand of about 10 million cubic feet, and having to cart all their materials to and from the works, would find at the end of the year that the cartage account was £160. If a railway siding could have been brought to the works, this charge would be replaced by a charge of £30 for handling materials, thus effecting a saving of £130 a year, which would be a saving of 7·5 per cent. on the total expenditure, and would reduce the price of gas by about 3d. per 1000 cubic feet. The question of level was one which also required attention; and the site should, if at all possible, be as low as, or lower than, any other point of the area of distribution. If a site not yielding a good natural foundation were chosen, it was surprising how soon the costs would mount up; and so the nature of the soil and subsoil called for early examination. In Scotland, the ground most frequently met with was rock, clay, gravel, or sand; and the qualities and conditions as they were found must be dealt with. A ground of homogeneous rock, such as whinstone, if at a convenient level from the surface, was the best possible; but instances had occurred where those responsible had been misled by assuming a thin substratum to be the real bed itself. Again, there had been cases where the rock was not so homogeneous as to form a large horizontal surface without some artificial filling-in; and it was difficult to render this as hard as the rock itself, in order to make the settlement absolutely uniform. Clay was generally considered to some extent an uncertain and troublesome foundation, on account of the irregularity of its strata, and its action on being disturbed; and its retention of water made it liable to yield unequally to the pressure of a building, and to move when exposed. But clays in different parts varied so much that no general rule could be laid down. The safest way to go about building on clay was to float the whole building on a wide solid ferro-concrete or simple concrete base. Some engineers advocated the piling of clay; but he had seen piles pushed up again, by the action of the neighbouring piles which were being driven, and this led one to

suppose that even were they successfully driven a working action might be set up among them with most disastrous results. A gravel ground was considered by many to be the best possible, if the stratum were thick. In such cases it was only necessary to sink a little into the stratum, though rather more than into solid rock, and to take care that the area of foundation was proportional to the weight per square unit the gravel was calculated to bear. Two advantages of gravel were that it was not affected by the action of the atmosphere, and that it was practically incompressible. Sand was quite a good material to build on if it was dry and confined laterally; but if subjected to the effects of water it became most treacherous, and if in contact with running water was liable to be scoured away from around the artificial foundations. These four simple foundations did not, however, call for any special treatment; and in each case the personal judgment of the engineer must be exercised. Another point in the selection of the site was the housing of the employees. It was well to bear in mind that the most desirable class of employee insisted on having a good house within reasonable distance of his work. The best could not be got from the employee unless he was satisfied with his conditions of work, one of the most important of which was his housing.

Having secured a suitable site, it was necessary to determine what class of buildings were to be constructed, though to a great extent the most useful construction for gas-works was concrete foundations or piers, brick buildings, steel or iron roofs, and brick chimneys. Stone buildings were not called for; wooden roofs were vetoed, because of fire; while steel chimneys would not, on account of the chemical actions prevalent, stand the test of time. No general rule could be given for the design and placing of the buildings and plant. Much depended on local conditions, though there was always the sequence resulting from the order of the manufacturing processes, which remained the same. The retort-house and coal-stores would probably be the first part of the work to be dealt with, and some points should be kept in mind with a view to economical working when completed. If possible, the coal-stores should be so constructed that the rail-level was considerably above the coal-storage floor, which would greatly reduce the cost of storage. Then there was the capacity of the stores to be considered; and perhaps a storage capacity of one-sixth of the annual coal consumption could be taken as a safe rule. The coal had then to be taken from the store to the charging-floor; and arrangements must be made to reduce handling there. If the works were fairly large, mechanical elevators could be utilized; but even where mechanical appliances were not to be installed, thought should be given to the relative positions and levels of the store and retort-house charging-floor. The retort-house itself should, above all, be of adequate dimensions, with plenty of width on the charging-floor and ample width at the furnace level for easy manipulation of cleaning tools. The building should be as high as possible. An additional 6 feet on the walls all round meant very little extra expense; the cost of the roof was in no way affected; and the efficiency of the building in every-day working would be greatly enhanced.

The condensers came next. They did not need more than careful attention as to capacity; and even then it was not necessary to go into detail as to the temperature of gases entering and the desired outlet temperature. A safe rule for their climate was 6 square feet of cooling surface for every 1000 cubic feet of gas made per day. By having the tar and liquor tank formed underground beneath the condensers, space was saved, and the arrangement was made more compact. The connections between the hydraulic main and the condensers were also a simple matter, though the question of introducing a retort-house governor with bye-pass ought to be seriously considered.

The exhauster and engine house was the next in order; and with this could be included the boiler-house and any plant for power that was to be used on the works. There was, of course, the question as to whether gas or steam was to be employed for the exhauster engines. While gas power presented many attractions, the fact remained that steam was a necessity for other parts of the works, such as the retort-furnaces, gasholder tanks and lutes, cleaning chokes in the tar-pipes, &c. It was easy to raise steam for the whole power; and in the majority of works it would be found best. The question of Lancashire *v.* Water-Tube Boilers also called for attention; and for most cases the author thought the latter type would be found the more efficient. In a large works, an "economizer" and a "superheater" might be introduced with advantage; but for smaller ones it was questionable if they were of much advantage, as the fuel that could be used with "forced draught" was at hand, and not of much value. The plant for producing power for stoking machines, coal and coke conveyors and transporters, and purifier work had also to be added; and for this purpose nothing was better than electrical energy, which could be generated very cheaply by a small dynamo, from which light for the purifier-sheds and other dangerous places could also be had.

The scrubbing and washing plant came next in rotation. So many types were at the disposal of the engineer, that it ought not to be a difficult matter to ensure efficiency. Probably, for the average case, a Livesey washer with a scrubber on top would be the best. In locating this, it was well to remember that if placed near the exhauster-house the man in charge there could supervise it as well, and so a constant saving could be effected. The purifier-shed and purifiers were next in order, and required careful consideration. The method of working to be adopted must be determined in fixing the dimensions and the depth of the purifiers, and allowing floor-space for hydrating lime and revivifying oxide of iron. The present tendency was to make the purifiers deeper than before, to obviate changing as much as possible; but extremes were often reached, and the ample depth allowed was found to be waste of material. Then there was the decision between "luted" and "luteless" purifiers; and there it might be borne in mind that water-lute purifiers had always proved effectual, and were not open to any serious criticism so long as the depth of the lute was equal to the maximum pressure. A floor area equal to three times the area of the purifiers should be about the proper thing, in most cases. Three boxes were allowed to be continuously in use; and a safe rule for capacity was to make the superficial area of each box slightly more than half the daily make in thousands. The connections should be the same diameter in inches as the area of the boxes in square feet. A suitable and inexpensive mode of housing for the purifiers was an arrangement of steel columns and girders, with a steel and concrete floor over for hydration and revivification, and surmounted by a simple iron truss roof, covered with corrugated iron or slates.

The station meter did not offer much choice, but ample room for inspection and repairs should be allowed; and the connections should be as far as possible open to view.

If the governors were of the underground type, regulated by tank and floating air-bell, connected to the governor proper by means of an air-pipe, the regulating bells and gauges could be installed inside the meter-house, which, besides being a compact arrangement, effected a saving in supervision. For the carburettor, a small house at the side of the meter-house would be found the most suitable method, and the necessary connections to the holders and governors a simple matter.

The last part of the works, so far as actual gas manufacture and handling were concerned, was the holder; and the choice in this mattter was confined to the following points: (1) Steel or concrete tank; (2) above or under ground; (3) system of guiding, whether column and girder, spiral, or cable; and (4) storage capacity. The capacity of the holders had to be considered, and if storage were allowed for 36 hours of the maximum demand, it should be all that was required. Some undertakings had considerably less than this; but an interesting experience the author recently had in this connection was, he thought, worthy of mention. When advising a town council as to storage, the question of the capacity available in other towns was raised; and various opinions were expressed thereanent. To settle the matter, he suggested that (say) thirty gas-works in Scotland should be chosen at random. The average storage of these showed, it was surprising to find, no less than 43 hours' maximum demand. But for all practical purposes the figure he had suggested—36 hours—was quite ample.

Efficient coke plant was necessary; and perhaps the best system in use was an arrangement of conveyors along the front of the retort-bench to the outside of the retort-house, and from there to the riddles or the storage ground, by means of overhead electrical transporters.

Workshops, too, had to be provided—such as a meter-shop, tinsmiths' and stoves shops, paint shop, and joiners', mechanics', and blacksmiths' shops; and the most economical method of dealing with these was, if possible, to have them constructed against one of the boundary walls, and all in line and of uniform elevation. Bathroom and lavatory accommodation ought to be considered a necessity in a gas-works, at least for the retort-house men, who should also have a room for dressing, and each man have a separate locker. A common room should be provided where the men who were on shift work could take their food comfortably. Room for the office staff had also to be found; and provision should be made for the separate accommodation of the clerical and technical departments, while, if possible, a good drawing office, lighted from above by a glass roof, should be provided on the upper floor. Some of the points he mentioned might seem trivial; but it was by the inclusion of these and many similar matters that a successful scheme was evolved.

All things considered, there could be no doubt that, for general gas-works structures, brickwork was the best mode of construction. It was too late, on the completion of the works, to discover that the materials employed were not sufficiently strong, or not suitable. The study of their strength and composition deserved careful attention from the engineer, so that the structures would not be designed too weak, either in parts or throughout, and so that no waste would occur in having them too strong for the work to be done. In both the construction and reconstruction of gas-works, uniform design should be preserved throughout. Though unnecessary expense was be avoided, an attempt ought to be made to impart to the structures some beauty of outline and finish; and in the arrangement of buildings and plant, the aim of obviating, as far as possible, manual labour in the everyday working of the concern must not be overlooked.

There were two methods of engineering procedure in such work—one was to ask contractors to submit designs and prices for the plant and apparatus; and the other for the engineer to design, detail, specify, and schedule the work, and then ask the contractors to quote prices for it exactly as described. As in most other matters, there was only one proper way of going about the work; and it was the latter. If several contractors were asked to submit designs for any plant, it would be found that not only did the prices vary, but that the materials to be

supplied differed in a great many ways; and therefore it would be totally impossible to compare the offers. This method was not only unsatisfactory from the point of view of the engineer, but at the same time was most unfair to honest contractors who were offering good workmanship and materials. If the proper method were adopted, and the work all detailed by the engineer, the prices received would be capable of immediate and fair comparison; and there would be no doubt as to the materials to be supplied and the work to be done under the contract. This system meant much more work for the engineer, for full detail drawings must be prepared, and the general conditions of the contract, detailed specifications, and full schedule of quantities and the form of tender had to be issued; but the result fully justified the work involved. On the completion of the works, a ground plan should be prepared, on which should be shown the exact positions of all pipes, valves, dips, and connections of every kind, and the respective depths marked thereon. In short, the plan should be an exact record of the whole construction.

The author said he had intended to devote more time to the methods of specifying and scheduling for the work; but he had found this impossible. In conclusion, he would give, as the motto of the engineer who was to design gas-works, the words "Economy with Efficiency."

Discussion.

Mr. A. Waddell (Dunfermline) said that Mr. Fyffe had gone so fully into the subject that he had given quite a general treatise upon gas-works construction. He must have taken a great deal of time and trouble over it, and deserved great credit for what he had done. He had brought before them things which it was very desirable to keep in mind. Probably Mr. Fyffe would not have done harm if he had chosen a gas-works of a certain size. They would then have had something more definite to go into. As to the capacity of the holders, 36 hours of the maximum make appeared to be very large. It would hardly be the holder capacity which they would care to ask for. Indeed, he recollected it being laid down, after discussion, that half a maximum day's work would be enough. Generally speaking, it had been regarded that 75 per cent. would do; and very few large works had ever claimed more than this. Now-a-days, when gas was so much used for fuel and power purposes, he thought the quantity spoken of by Mr. Fyffe was not too small.

Mr. J. W. Napier (Alloa) expressed pleasure in being present at a meeting of future engineers and managers, who were exhibiting such an amount of interest and enthusiasm as boded well for the industry. While it had been the case that honorary members had been conspicuous by their absence in the past, this had not been for lack of interest, but rather in the consciousness that the younger members were more likely to feel the responsibility of their new position, as also the position of their Association if left to carry out their transactions by themselves. Mr. Fyffe had dealt very adequately with the engineering of gas-works; but as Mr. Waddell had said, if a concrete instance had been taken, his communication would have lent itself to more definite criticism. The alpha and omega of gas-works construction lay in the first cost, as ultimately, in working out the selling price of gas, the cost per 1000 cubic feet was a very important factor. They frequently had new gas-works erected in such a manner as to indicate entire lack of knowledge in anticipating probable future demands; and, on the other hand, they had the opposite example, of works being erected where the future consumption had been very much under-estimated. The site of a gas-works, and the materials required, in great measure depended upon local circumstances. They might have a material which was plentiful in the district, and which might be obtained very cheaply. Then, as regarded the nature of the buildings, he had in his mind a small gas-works recently erected for an estimated manufacture of about 10 million cubic feet; and the lines gone upon, in this particular instance, were diametrically opposed to previous practice. The buildings there were not constructed either of stone and lime, or brick, but were entirely erected of iron. The retort-house, the workshop, and the exhauster and engine house, and the meter-house, were all constructed of iron; and, if his memory served him aright, the capital outlay for the buildings did not exceed about £250. He thought they would agree with him that, where capital outlay could be saved, it was a most important factor indeed. Mr. Fyffe touched upon so many points that it was somewhat difficult to gather up the threads in a moment. He desired, however, to make some criticism upon what he said about storage capacity. Inasmuch as the day consumption had increased to such an extent as to level-up the demand for gas, the question of storage must be calculated on an entirely different basis than heretofore; and he could not cite a better example than his own case. In Alloa, the storage capacity had not been increased since 1892, at which time the manufacture of gas was about 45 million cubic feet. During the present year, it would be up to 120 million cubic feet. He had as yet no necessity for increasing his storage; and it was certainly very far from his intention to increase it. The daily maximum was 560,000 cubic feet, and the storage capacity was only 300,000 cubic feet; but he had absolutely no difficulty in meeting the demand. In his case, they had an instance of a storage capacity practically equal to 50 per cent. only of the demand; and it might be taken as evidence of what was possible, having regard to the changed conditions of gas supply.

Mr. W. Brown (Lasswade) thought that 36 hours would be, perhaps, a little too much gasholder accommodation in the case of small works, such as his own. His opinion was that 24 hours was about the necessary provision. At this season, with the dull days (he had only about 45 per cent. of storage accommodation), he sometimes found himself in a rather tight corner. Mr. Napier had, perhaps, a carburetted water-gas plant, or something of the sort. Generally, in large places, they could rely upon some of these things to help them; but in his works he could not. He had all the retorts going, and sometimes found himself in a difficulty at the end of a week.

Mr. Forbes Waddell (South Queensferry) said that when he commenced, in small works, he had practically to reconstruct them; and they became new ones from beginning to end. When Mr. Fyffe was advising the members to go in for brick, and to leave out stone altogether, it occurred to him (the speaker) that his would have been a case where it would have been very foolish not to have constructed the buildings of stone, for the simple reason that there was a railway freight of perhaps 150 miles for bricks, and there was a good stone quarry near. What a young man constructing gas-works had to do was to think what would be the best materials to use, taking into consideration not only the cost but everything else. As Mr. Napier had said, it was of the greatest importance that the capital of a gas-works should be kept as low as possible, because if they had (say) £3000 expended upon works which they might have put up for £2000, it meant they would get 5 instead of 7½ per cent. dividend. He was now running a small place where he was selling 3 million cubic feet annually. His storage capacity was only about 10,000 cubic feet; and the maximum daily make was 20,000 cubic. He had only one man in the works, and he had not the slightest trouble in carrying them on. He had done his very best to get a day consumption; and his circumstances were, perhaps, more favourable than those of most other gas managers in this respect, because he had a very good consumer, who was practically a day consumer, in addition to a number of cookers. The cooker could always be worked for what it was worth; and then it was a question of increasing their storage plant, but perhaps a matter of putting up an extra setting. His man damped down every night; and he did not think this had added to the cost, so far as fuel consumption was concerned, because he sold between 7 and 8 cwt. of coke per ton of coal carbonized.

Mr. H. Rule (Falkirk) said he appreciated Mr. Fyffe's paper very much, because he always thought there was a fascination about the construction and reconstruction of works which there was not in any other branch of their profession. With regard to cartage, he might say he had had a good deal of experience in this matter, because in their new works at Falkirk they made a saving of fully 7d. per ton of coal, upon this item alone. The results which had followed the introduction of retort-house governors had certainly justified their adoption. He considered it hardly necessary to go to the expense of putting in costly forcing apparatus. The ordinary steam injector could be easily applied to any boiler; and he thought it would be found to be quite good enough. It would enable managers to burn the breeze and the poor stuff, which they were all anxious to use up. As to luteless as compared with water-lute purifiers, having had experience of both he would scarcely care to go back to the latter. He had not the slightest trouble with the rubber lutes; and, especially during frosty weather, this was a great consideration. In his opinion, Mr. Fyffe was rather out in the matter of purifier connections. His view seemed to be that a 30-feet square governor should have a 30-inch connection. He (Mr. Rule) thought less than this would do. They had at Falkirk 18-inch connections to 30 feet square purifiers, and obtained very good results indeed. The type of gasholder to be erected was, of course, a question of cost. He found, on going into this matter some time ago, that the difference in cost between a column-guided and a spiral-guided holder was as much as £2000 on a holder of a million cubic feet capacity. So that it was for the gas engineer to say whether he would spend this extra £2000. The capacity of gasholders had, to a certain extent, to be settled by local conditions. In a town which was subject to fogs, 50 per cent. would hardly do; but he thought the question could easily be left to the engineers concerned. At Falkirk they had nearly 36 hours' storage capacity; and, especially at week-ends, they found this very handy, because it saved them shutting down.

The President expressed the opinion that Mr. Fyffe had advocated too strongly electricity for power. It was quite good enough for small machinery, such as that used for stoking; but for heavy work—coal-conveyors, for example—he was doubtful about its economy. He did not consider it would be anything like so cheap as steam power. Mr. Fyffe had spoken about ferro-concrete. Some of the members did not know very much about it—as to its cost or its life.

Mr. Fyffe thanked those who had offered criticism for pointing out the various matters they had indicated. It was suggested that he might have taken a fixed size of works to deal with. As a matter of fact, he had seriously thought of doing this; but it struck him that anything he might say would be confined to that size of works, and he considered it might be more useful to deal with them generally. He did not intend to suggest that 36 hours was the proper storage capacity in every case. What he meant was that, in constructing works, 36 hours was a safe storage capacity to allow for the load expected to be dealt with, because it was not good policy to erect a gasholder straight away, to be extended along with the retort-house and other plant, but to allow

a few years to elapse before it was enlarged. At the same time, the fact that in thirty towns in Scotland taken at random, 43 hours' storage was found to be sufficient, seemed to point in the direction he advocated. It was suggested that he kept too closely to brick as the material for construction. Of course, it was merely a general statement that the paper was intended for. He could not specify such cases as those in the far North. Not long ago he reconstructed works in the North where they used granite as the building material, simply because of the freight. The President had mentioned electric power. It was a large question; but there was some very good and very valuable electric plant on the market just now. For instance, the Temperley transporter for coke would compare favourably with any other machine at the present day. As to ferro-concrete, it was of so recent introduction that it was impossible to say what its cost and duration might be. It was simply a combination of steel and concrete, intended to give greater strength with cheaper materials. The subject could not be gone into in detail there. He had to thank the gentlemen who had mentioned these points, as they were all helpful.

The PRESIDENT said he was sure the members were all much indebted to their Vice-President for the interesting paper he had read to them. He had given them many valuable hints as to gas-works construction, and had made the subject interesting. The members would derive much benefit from a study of the paper; and he was sure the author of it would also be benefited by his work. He asked them to accord a hearty vote of thanks to Mr. Fyffe for the trouble he had taken in preparing and reading the paper.

The members cordially acquiesced in the suggestion.

On account of the lateness of the hour, it was agreed to postpone discussion upon the two subjects upon the *agenda*.

The HON. SECRETARY (Mr. J. R. Moyes) stated that he had had a letter from the Secretary of the Midland Junior Gas Association, requesting them to appoint two members to attend a joint meeting of representatives from the Councils of the Junior Associations, to be held in Birmingham next month. He explained that there had not been a meeting since the letter was received, and the subject was now laid before the members for their decision.

It was agreed, after a discussion, that the President and Vice-President be appointed to attend the meeting.

The HON. SECRETARY also intimated that their next gathering would be on the occasion of a visit, on the 1st prox., to Messrs. R. & A. Main's works at Falkirk.

A Practical Comparison of Gas with Electricity.

A very interesting and instructive exhibit, illustrating in a practical way the comparative cost of lighting by gas and electricity, was provided at the annual *conversazione* of the Birmingham Scientific Society last week, by one of the members, Mr. Enoch Evans. Three lamps fitted with opal glass (which completely concealed the sources of light) were placed side by side, the illumination of each being practically equal as far as an observer could judge. One of the lamps was lighted by an inverted incandescent gas-burner, another by a large flat-flame burner, and the third by an electric tantalum lamp; and underneath each was a meter showing the consumption of gas or electricity. At the prices charged at present for gas and electricity in Birmingham, it could be seen by a few minutes' observation that the cost of each lamp per 1000 hours was—

	£	s.	d.
Inverted incandescent gas	0	9	5
Flat-flame gas	2	5	0
Tantalum electric lamp	3	12	0

Simple as the exhibit was, it proved to be a very popular one, and not a few visitors were tempted to see for themselves what the comparative cost of the rival illuminants really is.

At the ordinary monthly meeting of the Institution of Civil Engineers last Tuesday, it was announced that Mr. F. Chenery Suggate had been transferred to the class of members; and among the admissions to this class, as the result of the ballot taken on the occasion, were Mr. Alexander Smith, of the Tradeston Gas-Works, Glasgow, and Mr. H. J. Rofe, M.A.

An announcement from M. Coze, the President, has just reached us that this year's meeting of the Société Technique du Gaz will take place in Paris on June 23 and following days. The last date for sending in competitive essays is March 1; but for members' papers to be read at the congress, the date is May 23. It will also be remembered that entries for the small gas-engine competition have to be sent in by April 1.

The Committee of the Waverley Association have resolved, in view of the holding of the Scottish National Exhibition in Edinburgh this year, to postpone the annual meeting of the Association from the usual date in April to a Friday in June—the particular day being left to a Sub-Committee to determine. The meeting will, if arrangements can be made, be held in the Exhibition; and instead of an excursion, the members will spend the afternoon in the building.

GAS-ENGINE RESEARCH.

Professor F. W. Burstall's Third Report.

At the Meeting of the Institution of Mechanical Engineers last Friday, the third report presented by Professor F. W. BURSTALL, of the Birmingham University, to the Gas-Engine Research Committee of the Institution, was submitted for discussion. The first and second reports were presented in 1898 and 1901, and were dealt with in the "JOURNAL" at the time (see Vol. LXXI., p. 399, and Vol. LXXVIII., p. 1030.) The following are the principal portions of the third report.

In the reporter's reply to the discussion of the second report, he stated "that in a gas-engine there should be no boxes or unnecessary parts; there must be some holes for the valves, but there should be no pockets in the side, nor anything of the sort. The valves should all work in the back. In that way one would have a cylinder which had the minimum of surface for the maximum of volume." When the new University at Edgbaston, Birmingham, was being projected, advantage was taken of the fact that a power station had to be installed to supply the necessary current for power and lighting, and that, for educational purposes, the station had to be equipped with both steam and gas engines. After considering most of the leading types of engines, it was decided that, in order to carry out as fully as possible the principles involved in the foregoing statement, it was desirable to obtain an engine which would not only satisfy the above conditions, but would also allow a much higher compression than was possible in the former experiments, without at the same time requiring the use of water or any fluid for the purpose of preventing pre-ignitions. The use of a scavenger charge was therefore thought desirable; and for this reason the building of the engine was entrusted to the Premier Gas-Engine Company, who had already made a positive scavenger engine, though not one of the type that was required. As it was out of the question, on the score of expense, to construct an absolutely novel type of engine, it was decided to adapt one of the Premier Company's existing types to the required form.

The engine chosen was that designated by the letter "O," capable of giving 150 H.P. at a speed of 170 revolutions per minute; the size of the cylinder being 20 inches diameter and 24 inches stroke. In order to enable the engine to run at a compression pressure of 200 lbs. per square inch, with charges which were estimated to give an initial pressure of 600 lbs. per square inch, the diameter of the cylinder was reduced to 16 inches; and, at the same time, in place of using the standard admission-valve on the top and exhaust on the bottom, an entirely new breech end was constructed, with admission and exhaust valves horizontal —care being taken that the interior of the cylinder should have a perfectly flat end, like the cylinder of a steam-engine.

The engine was so constructed that it could be worked on any one of the three known systems of governing—viz., (*a*) keeping the quality of the mixture constant and varying the amount; (*b*) keeping the quantity of the mixture constant and varying the amount of gas; and (*c*) hit-and-miss, or cutting-out of charges. The engine was originally arranged to work on the first system; but during the whole of the experiments it was arranged to work on the second.

The working of the engine is as follows: Starting with the suction stroke, the combined air-and-gas valve is opened to a predetermined point, by a pivoted lever under the control of the governor, and a positively driven pecker block, actuated by the half-speed shaft; the governor thus controlling the opening of the air-and-gas valve. The mixture, after passing through this valve, enters through the breech end into an annular casing, which contains the inlet-valve, and then into the cylinder itself. After shutting the inlet-valve, the usual sequence of compression, explosion, expansion, and exhaust follows; but about half-way along the exhaust stroke a second valve, called the "scavenger" valve, lying alongside the mixing-valve, is opened from the lay shaft, and allows a current of cold air from the differential piston to enter the motor cylinder. This serves the double purpose of clearing out the exhaust products, and at the same time cooling the inner surfaces. During the idle stroke of the engine, this scavenging charge is simply compressed and expanded in the passages leading up to the mixing and scavenger valves. So as to prevent, as far as practicable, any possibility of pre-ignitions occurring through hot surfaces, every part of the engine exposed to the flame is water-jacketed; and in order to estimate the amount of heat rejected through each of these surfaces, the water services are taken from separate measuring-tanks, and discharged without a mixture from water from any other surface. The temperatures of discharge were in each case measured by thermometers placed in the outlet pipes.

The engine works entirely with producer gas made from bituminous fuel, supplied from a 500 H.P. producer of the Mond pattern, made by the Power Gas Corporation. After the gas has passed through the sawdust scrubbers, and entered the power-house, it goes into a standard wet gas-meter, having a capacity of 8000 cubic feet of gas per hour, made by Messrs. Braddock, of Oldham. On issuing from the meter, the gas passes through a Stott governor to the engine. Without the governor, it was found that the suction of the engine produced violent oscillations of

the water in the meter, which, besides affecting the accuracy of the readings, threw it out of order. Before commencing the tests, the meter was calibrated against a standard meter by Messrs. Braddock, and the water level was kept constant throughout the whole of the experiments by running water continually through the meter.

Ignition.—The engine was at first fitted with the ordinary make-and-break ignition, working from a 110-volt circuit. This worked quite satisfactorily until the compression pressure was raised to 140 lbs. per square inch, when premature ignitions resulted from the heating of the points. High-tension ignition seemed to offer the most favourable opportunity of success; and of such the best seemed to be the Lodge ignition, the reporter's experience of which is that it gives no trouble, provided the batteries which supply the primary current are always kept charged.

Object of the Tests.—The tests were undertaken to determine in the first place the thermal efficiencies based on the indicated horse power, at various compressions, having regard to the richness of the mixture, and, in the second place to formulate, if possible, the law connecting efficiency and compression. Thus at each compression it was proposed to run a series of trials with different mixtures, which was done by using a number of different mixing-valves in which the ratio of the air and gas ports varied. Had the composition of the gas throughout the tests been uniform, this would have been a simple matter; but as the producer plant was generally worked at a fairly light load, it was impossible to ensure beforehand that the composition of the gas should be exactly what was required for the particular valve employed. The calorific value of the gas aimed at throughout the tests was 160 B.Th.U. per cubic foot (lower value).

In the first instance, a number of preliminary tests were run with various ratios of compression, in order to obtain some idea of the engine generally and of the degree of accuracy with which experiments could be made. As was only to be expected in a novel engine, a considerable number of changes had to be made, particularly in the governing mechanism. New air-and-gas valves, with an entirely new arrangement of cams for driving them, had to be constructed; so that the engine as used for the trials differed materially from the ordinary Premier engine—to such an extent, indeed, that it should be discussed entirely on its own merits.

During the preliminary trials, several types of indicators were used, including the Wayne rotary, which was employed on the former trials, when using coal gas. This, however, was found to be so sensitive to the small quantities of dirt present with the producer gas that its use had to be abandoned, and the Crossley indicator used instead. All the diagrams were taken by Mr. J. F. Gill, the reporter's assistant; the greatest care being exercised in view of the fact that the indicated power was the most important measurement to be made. The power required to drive the engine itself was estimated from electrical data to be about 22 H.P. at full load, and from similar data the power empty to be about 20·8 H.P. In all cases the indicated horse power is calculated from the actual mean effective pressure on the piston.

The compression of the engine was varied by inserting packing pieces at the big end of the connecting-rod, so that the compression space was always cylindrical in form; thus removing one of the defects of the former set of trials, in which the compression was varied by bolting a junk-ring to the back of the piston. The variation in the mixture was obtained by using gas-valves having different sized ports for both air and gas, and also by throttling down the gas at the inlet. Though this latter method is very much more limited than could be desired, owing to the fact that it only alters the quantity of gas, it will be highly desirable, in an engine of this kind, to have the air for suction separate entirely from that for scavenging, so that both the air and the gas can be throttled during the progress of running the tests. This, however, was not foreseen at the time the engine was constructed; and though the change could have been made, it would have involved a considerable amount of alteration, which would have very much delayed the publication of the results.

Exhaust Gases.—As the engine used a scavenging charge, a simple sample of the exhaust gases would contain a very considerable quantity of air from that charge. To obviate this difficulty, a small sampler was designed to take a sample of the gas out of the exhaust-pipe directly the exhaust-valve was opened, and before the scavenger charge passed into the exhaust. This worked very well mechanically; but it gave a larger proportion of free air than was expected—proving that the gas in the exhaust-pipe did not represent the composition of the charge in the cylinder when the exhaust-valve was opened. The whole of the exhaust gases obtained in some of the trials were too low in carbon dioxide and too high in oxygen, and the figures for these trials were therefore discarded. In all the other trials, the gas was sampled from the engine cylinder itself by a mechanically operated valve in the centre of the breech end. This no doubt gave the accurate composition of the gas in the cylinder, from which it might be noticed that the charges contained 1·9 to 10·5 per cent. of free oxygen.

Determination of the Heating Value of the Gas.—The heating values were obtained not only from the analysis of a sample drawn continuously throughout the whole of the tests, but also from the Junkers calorimeter, which also ran continuously. During the preliminary tests, it was noticed that the values from analysis and from the calorimeter did not agree, and that they varied capriciously. As the lower value deduced from the calorimeter necessitated the determination of the amount of water condensed, and this quantity varied according to the hygrometric state of the atmosphere, it was considered essential that the calorimeter should work either with dry air and dry gas or with saturated air and saturated gas; and the latter condition was chosen. In the arrangement of the calorimeter employed, both air and gas were led through coke-packed towers over which a stream of water was steadily trickling, so that they issued from these towers saturated. From these the air and gas were led through a coil of pipe placed in the outlet of the calorimeter, so that incoming air, incoming gas, and outgoing products of combustion were automatically reduced to the same temperature. In other respects the calorimeter was used as was customary. This arrangement had the effect of giving the amount of condensed water in the calorimeter a closer value than usual to that obtained from analysis, and also produced a remarkably close agreement between the calorimeter values calculated from analysis and those observed.

Results of the Tests.—It is not proposed to analyze at length the results which are given in the tables on p. 177, as it would not only take up a great amount of space, but might possibly lead to misapprehension, on account of having to employ constants the values of which are not agreed upon by all authorities. In considering the thermal efficiencies, it will be noticed that for each compression there is a particular mean pressure which gives the highest economy for that compression. This pressure appears to range between 85 lbs. and 95 lbs. for all compressions, with the tendency to increase as the compression goes up. Higher mean pressures than these caused the efficiency to fall off, as is shown in tests Q1, F2, F5. The rise in efficiency with the compression is very marked from the Q to the F trials, rising from a minimum of 28 per cent. up to a maximum of 39 per cent. After this point the efficiency increases comparatively slowly, reaching the maximum of 43 per cent. on the C trials, and then diminishing to 39 per cent. on the highest compressions of all. This result does not accord with the usual belief that economy increases with compression, when a suitable mixture is used. The cooling action of the walls, however, affects the result materially. Consider the contents of the cylinder at the end of the compression. The gas is confined in a space 16 inches in diameter—at the highest compressions about 3¼ inches long, and at the lowest about 6½ inches long; the gas being entirely surrounded by water-cooled surfaces. This being the case, the leakage of heat during compression will be greater proportionately at the high than at the low compressions, because the higher compression is accompanied by a higher density and by a temperature difference between the walls and the charge; and this more than compensates for the reduction of the area of surface exposed to the gases. Hence, after some definite compression is reached, further compression will result in a loss of economy and not a gain. For this particular engine, the most economical compression pressure is apparently 175 lbs. per square inch; but, of course, the compression that will give the highest economy will vary according to the design of the clearance spaces. It does not, however, seem to be probable to get a design which will give better results than in the engine experimented upon.

To obtain higher thermal efficiencies by the aid of higher compressions, it would be necessary to increase the stroke of the engine in proportion to its diameter. In the particular engine experimented upon, the stroke is about one-and-a-half times the diameter. If the stroke were twice the diameter, it might be possible to employ a higher compression pressure. In this way the disc of hot gas might still be kept fairly thick. But, of course, such a method would mean slower speeds of rotation for a given piston speed; and thus it is quite probable that the lower speed of rotation might produce prejudical effects, which would more than counterbalance the gain due to heat losses. Very high mean pressures, extending to some 114 lbs. per square inch, were proved to be very decidedly uneconomical; the economy falling from 39 to nearly 32 per cent. in the cases of F4 and F5. Such mean pressures were not used on the C, B, and A trials, because during the preliminary trials it was found that the economies were not good, and, moreover, that the maximum pressures produced (some 600 lbs.) were too high for safety. In the actual tests, the maximum pressure that was allowed was 550 lbs.; and this was only rarely reached. The heat rejected to the cooling water does not represent the whole of the heat lost to the walls, because the scavenger charge carries some portion of heat from the interior walls of the cylinder, and this heat is thrown into the exhaust. Hence, the values found for heat rejected into the jacket water are lower than those which are generally obtained from non-scavenger engines.

It will be noticed that in most cases the high thermal efficiencies coincide with the lowest percentages of heat lost in the cooling water, as, for instance, in the trials C1, D5, F4; while in the case of the A test, at the very highest compressions of all, the quantities of heat rejected are greater than those in the B and C trials—thus corroborating, to some extent the conclusion that it is possible to carry the compression too high in a particular engine. The thermal efficiencies throughout are computed by taking the heat values from the Junkers calorimeter, which was kept running throughout the entire period of the tests.

Analyzing the exhaust gases, it is possible to calculate the ratio of air to gas; and then, by assuming that the scavenger charge entirely removes all the products of combustion, to calculate the temperature at the end of the suction stroke. This has been done for the trials in which the mechanically operating sampling-valve was used; and it gives the ratio of the air to gas varying from

TABLE *of Pressures, Power, and Thermal Efficiency.*

Test No.	Spark.		Compression Pressure.		Mean Explosion Pressure.		Mean Effective Pressure.		Revolutions per Minute.	Indicated Horse Power.		Average Thermal Efficiency.	Heat Account.		Mean Effective Pressure on Suction.	Mean Effective Pressure on Scavenger Reduced to Area of Piston.
	Position of Crank when Contact was made, in Degrees, before Dead Centre.	Distance of Piston per Cent. from End of Stroke.	Pounds per Square Inch.	Kilos. per Square Centimetre.	Pounds per Square Inch.	Kilos. per Square Centimetre.	Pounds per Square Inch.	Kilos. per Square Centimetre.		British.	Metric.		British Thermal Units per Indicated Horse Power.	Percentage to Cooling Water.		
A 1	63	0·25	212	14·9	358	25·2	80	5·63	168	81·9	82·9	0·394	6431	23·9	2·81	0·6
A 2	54	0·24	222	15·6	384	27·0	86	6·01	168	87·6	88·8		6485	20·5	2·72	
B 2	66	0·34	201	14·1	360	25·3	87	6·14	168	89·1	90·4	0·398	6360	18·0	1·90	0·8
B 3	68	0·36	191	13·4	330	23·2	82	5·80	168	84·1	85·2		6439	16·4	1·64	
C 1	69	0·36	172	12·1	356	25·0	90	6·31	167	91·0	92·3	0·415	5930	17·1	..	0·7
C 2	48	0·19	175	12·3	324	22·8	92	6·49	171	96·1	97·4		6384	21·5	1·67	
C 3	54	0·22	168	11·8	293	20·6	87	6·14	170	90·2	91·4		6186	20·6	1·76	
C 4	46	0·18	175	12·3	343	24·1	99	6·97	170	103·0	104·2		6069	23·2	2·32	
D 2	52	0·22	159	11·2	408	28·7	106	7·41	170	109·0	110·6	0·404	6295	23·2	2·15	0·7
D 3	54	0·33	166	11·7	388	27·3	110	7·70	170	113·0	114·7		6398	23·1	4·45	
D 4	65	0 33	154	10·8	309	21·7	82	5·79	170	85·3	86·5		6435	19·4	2·06	
D 5	60	0·28	158	11·1	334	23·5	93	6·52	173	97·8	99·1		6110	12·2	2·10	
F 1	67	0·35	137	9·6	311	21·9	93	6·55	170	96·3	97·7	0·359	6485	16·7	2·10	0·6
F 2	38	0·12	129	9·1	430	30·2	114	8·02	167	116·0	118·0		7839	25·8	2·20	
F 4	57	0·27	132	9·3	309	21·7	86	6·07	169	88·6	89·8		6522	15·8	3·10	
F 5	34	0 10	129	9·1	354	24·9	113	7·93	169	116·0	118·0		7757	22·4	3·00	
J 1	57	0·27	124	8·7	330	23·2	82	5·73	168	83·2	84·4	0·345	7315	30·9	2·68	0·5
J 2	36	0·11	132	9·3	414	29·1	106	7·47	167	108·0	110·0		7520	27·3	2·75	
J 3	36	0·18	124	8·7	358	25·2	94	6·58	167	95·2	96·6		7086	27·6	3·40	
Q 1	49	0·20	88	6·2	341	24·0	100	7·01	167	101·0	103·0	0·30	9012	27·8	2·60	0·5
Q 2	72	0·40	87	6·1	228	16·1	72	5·04	168	73·3	74·4		8462	26·6	2·64	
Q 3	53	0·24	87	6·1	270	19·0	88	6·20	168	90·2	91·5		8088	27·8	3·22	

TABLE *of Analysis of Gas.*

Test No.	Volumetric Composition of Gas (Per Cent.).						Combustible Gas. (Per Cent.)	Test No.	Volumetric Composition of Gas (Per Cent.).						Combustible Gas. (Per Cent.)
	CO_2.	O.	CO.	H.	CH_4.	N.			CO_2.	O.	CO.	H.	CH_4.	N.	
A 1	11·2	0·0	18·9	23·0	3·6	43·3	45·39	F 1	11·2	0·0	17·5	20·0	4·2	47·1	41·72
A 2	8·8	0·0	21·9	19·3	3·4	46·6	44·62	F 2	10·1	0·0	19·2	20·8	3·0	46·9	42·97
B 2	11·2	0·0	19·6	21·2	2·9	45·1	43·70	F 4	7·1	0·4	23·2	21·2	4·6	43·4	49·10
B 3	3·8	0·0	20·0	22·9	3·3	50·0	46·23	F 5	11·3	0·0	15·6	26·2	5·2	41·7	47·02
C 1	..	..	..	..	..	..	..	J 1	8·6	0·2	23·3	21·8	2·9	42·8	48·41
C 2	7·8	0·0	23·0	20·2	2·6	46·4	45·89	J 2	9·3	0·0	18·0	22·6	4·9	45·2	45·47
C 3	7·8	0·0	22·0	20·7	3·0	46·5	45·64	J 3	8·5	0·2	23·1	20·0	3·0	45·2	46·10
C 4	9·1	0·0	21·7	21·1	3·0	45·1	45·77								
D 2	3·8	0·0	26·5	17·6	4·9	47·2	49·02								
D 3	3·9	0·0	27·3	17·0	4·6	47·2	48·79	Q 1	10·3	0·0	19·4	19·6	5·2	45·5	44·20
D 4	11·1	0·0	8·3	26·3	4·0	50·3	38·61	Q 2	12·9	0·0	16·3	22·1	4·3	44·4	42·77
D 5	7·7	0·0	22·3	20·2	2·8	47·0	45·24	Q 3	..	..	..	..	..	..	..

TABLE *showing Calorific Value of Gases.*

Test No.	Gas (Wet) at 0° C. and 760 mm. Hg.		Total Gas (Wet) at 0° C. and 760 mm. Hg.	Calorific Value of Gas.					
				By Junkers Calorimeter (Wet.)				By Analysis (Dry).	
				Higher Value at 0° C. and 760 mm. Hg.		Lower Value at 0° C. and 760 mm. Hg.		Higher Value at 0° C. and 760 mm. Hg.	
	Cubic Feet per I.H.P. Hour.	Cubic Metre per Metric H.P.-Hour.	Cubic Feet per Hour.	B.Th.U. per Cubic Foot.	Calories per Litre.	B.Th.U. per Cubic Foot.	Calories per Litre.	B.Th.U. per Cubic Foot.	Calories per Litre.
A 1	38·45	1·076	3150	181	1·61	167	1·49	180	1 60
A 2	39·30	1·100	3440	177	1·58	165	1·47	176	1·57
B 2	38·45	1·076	3430	179	1·59	165	1·47	170	1·51
B 3	38·67	1·082	3255	181	1·61	166	1·48	181	1·61
C 1	38·45	1·076	3500	167	1·49	154	1·37	..	..
C 2	38·22	1·070	3672	180	1·60	167	1·49	175	1·56
C 3	38·28	1·071	3452	174	1·55	162	1·44	177	1·58
C 4	37·98	1·063	3905	173	1·54	160	1·42	177	1·58
D 2	33·40	0·935	3645	201	1·79	188	1·68	202	1·80
D 3	34·10	0·954	3858	199	1·78	188	1·67	199	1·77
D 4	47·00	1·316	4012	152	1·35	137	1·22	161	1·43
D 5	37·77	1·057	3693	176	1·56	162	1·44	174	1·55
F 1	39·68	1·111	3820	176	1·57	163	1·45	172	1·53
F 2	48·45	1·356	5632	175	1·55	162	1·44	167	1·49
F 4	34·63	0·969	3069	203	1·81	188	1·68	200	1·79
F 5	45·12	1·263	5235	188	1·67	172	1·53	198	1·76
J 1	42·70	1·195	3553	180	1·61	171	1·52	184	1·64
J 2	45·63	1·277	4935	180	1·60	165	1·47	190	1·69
J 3	44·56	1·247	4244	172	15·3	159	1·42	179	1·59
Q 1	51·05	1·429	5178	190	1·69	176	1·57	187	1·67
Q 2	50·77	1·421	3721	180	1·60	167	1·48	176	1·57
Q 3	48·30	1·352	4360	182	1·62	167	1·49	..	..

Test No.	By Analysis (Dry).	
	Lower Value at 0° C. and 760 mm. Hg.	
	B.Th.U. per Cubic Foot.	Calories per Litre.
A 1	166	1·47
A 2	164	1·46
B 2	156	1·39
B 3	167	1·48
C 1	..	..
C 2	163	1·45
C 3	164	1·46
C 4	164	1·46
D 2	188	1·68
D 3	186	1·65
D 4	144	1·28
D 5	161	1·44
F 1	158	1·41
F 2	154	1·38
F 4	186	1·65
F 5	180	1·60
J 1	170	1·52
J 2	174	1·55
J 3	166	1·48
Q 1	173	1·54
Q 2	162	1·44
Q 3	..	..

1·6 to 3·6, and suction temperatures varying from 44° to 121° C. (111° to 250° Fahr.). The maximum temperature was 2000° C. (3632° Fahr.), dropping to as low as 1200° C. (2192° Fahr.) in all the economical runs of the tests given in the C trials.

Conclusions.—The whole of the experiments appear to point conclusively to the fact that the most economical mean pressure is very considerably below the maximum which can be obtained, and that the highest economies are obtained with the comparatively low maximum temperature. Both these results imply that the engine should not only be subjected to lower pressure but to lower temperatures as well, and thus many of the difficulties which arise in large engines from rich charges might be avoided, and the maximum pressures kept down to quite reasonable limits. This, of course, only applies to the indicated power; and the conclusions as to the brake-horse-power would be widely different. If, however, the engine is constructed to work only with these moderate pressures and temperatures, all the working parts might be much lightened, and thus good mechanical efficiency obtained with the very moderate mean pressures.

The question of the liability to premature ignitions of gas containing larger or smaller percentages of hydrogen, was borne in mind throughout these experiments. But in every case of premature ignition which occurred—and there were many such cases—with compressions higher than 160 lbs. per square inch, it was traced to dirt or carbonized oil in the cylinder, or to some part having become overheated; and such premature ignitions took place equally with a weak as with a rich gas. The reporter is of opinion that, so far as premature ignition goes, the compression might be made a great deal higher than any used during these experiments; but in view of the fact that the economy falls off after a certain point, there does not seem to be any useful object gained in going to any higher compression.

[Professor Burstall concludes with an acknowledgment by the author of his great obligations to the several gentlemen (all named) who assisted him in carrying out his experiments, as well as his indebtedness to the Council of the University of Birmingham for having made it possible to conduct the trials on so large an engine as the one used for them. The report is followed by two appendices—one on the form of the expansion curves, and the other on the gas-analysis apparatus—several tables of results, three of which we reproduce, and eight plates.]

Professor Burstall, in some introductory remarks, referred to the way the engine used in the tests had developed from the engine employed in the former test, because he thought it was somewhat of an illustration that it was possible to learn a great deal even from bad appliances. Those familiar with what was done before would remember that the work was then carried out on a single engine, with 6-inch cylinder and 12-inch stroke, running at 200 revolutions per minute. The compression of the engine was altered by way of the connecting-rod, and it was also altered by a packing-piece on the back of the engine—this being rendered necessary by the fact that the combustion chamber was, approximately speaking, a half-sphere; the inlet and exhaust valves being at the bottom. One considerable fact that struck him during the experiments was that the changes that were made in the quantities of gas admitted to the quantities of air did not appear to produce themselves as regarded work done. The only effect, or very nearly the only effect, of putting in more gas was to throw more heat into the circulating water. That was the position about the middle of 1901. Then, by a series of fortunate occurrences, it became his lot to inquire into the possibilities of getting an engine which primarily should be used for the generation of electric current, to be used for the general purposes of the Birmingham University. He thought he would endeavour to combine the two sets of conditions, and get an engine which could also be used for research purposes, and give a greater range than the engine of which he had previously had experience. In this, as in other matters, it was necessary to compromise to a large extent; for if he had made drawings for a 150-horse power engine absolutely novel, and then asked his Council to stand the expense, he would never have had an engine. Therefore, what he did was to try to adapt an existing form of engine to suit the purposes, in the first instance, of the research, and, at the same time, to keep in mind the fact that the engine had to do a commercial work. He trusted this would not be lost sight of in the discussion—that the engine had always done the work of an ordinary engine; and so it could be in no sense considered a freak, or an engine that was out of question for commercial purposes. He might be asked why he went to all this trouble to put in such an elaborate engine when he could have got a perfectly simple hit-and-miss engine to do the work. That was the whole point. He considered, if he had confined himself to an ordinary hit-and-miss engine, he could not have obtained any more information than anybody else could. He was anxious to do something which had not been done before. He put in a scavenger charge, because he had no hope of getting to high compressions without cooling of some kind other than that of water cooling. The inner surface of a gas-engine of this size was exposed to such a high temperature that it would become so heated as to fire the charge spontaneously when drawn in.

Discussion.

The Chairman (Mr. J. A. F. Aspinall) said they had to thank Professor Burstall for the long and laborious investigation he had made into this subject. He was satisfied, as far as Professor Burstall was concerned, that the deeply interesting character of the work had brought to him both reward and interest; and the members had the great advantage of the records he had so carefully placed before them.

Sir Alexander Kennedy, Chairman of the Gas-Engine Research Committee, observed that the paper did not by any means indicate the enormous amount of work that had been done by the reporter. He had been working on a commercial engine of considerable size, and had endeavoured to get results that might be of use to any of them who wished to apply them to commercial engines. Since the work covered by the report was completed, several other points had been raised here and elsewhere about gas-engines, with the result that it had been decided to pursue the investigations; and Professor Burstall had offered to help them in the matter of running the best series of tests—the most economical kind—on the brake instead of only on the dynamo. An optical form of indicator with a mechanical indicator in parallel would be used, so that they would be able to see the difference in their results.

Captain Sankey thought the paper boiled down to two important facts—one was the reduction of thermal efficiency after a certain number of compressions had been reached, and the other was that with moderate mean pressures the best results were obtained. He enlarged on these two points, by the aid of the blackboard, and incidentally pointed out that, when there were moderate compressions and moderate temperatures in the cylinder of an engine, the losses would not be very great. At the Derby trials of suction plants, there were a number of small engines used with varying compressions; and although in that case the efficiency of the suction producer did come into consideration, it was quite noticeable that, in regard to certain compressions, the final result was not so good. One engine had a high compression indeed; and the result of this engine was not so good as that of another engine with lower compression. Another point of extreme importance in the paper was (he might call it) the new arrangement of Junkers calorimeter. Professor Burstall's assistant deserved great praise for this addition. He wished the brake efficiency of the engine had been given. But it could be deduced from the figures in the paper; and it came out to 78 or 79 per cent. From the theoretical point of view, the figures were all right.

Professor Hopkinson said Captain Sankey had already drawn attention to the conclusion that, at a certain point, the increase of compression in this engine did not lead to increased efficiency. One of the best-known deductions in gas-engine efficiency and theory was that the efficiency did go up with compression; and moreover that it went up more or less in proportion to the efficiency of an ideal air-engine working at the same compression. These experiments at the lower compressions were a further proof of this deduction. They showed that at a compression of about 80 lbs. up to about 180 lbs., the efficiency steadily increased. Professor Burstall, however, inferred that, at higher compressions, the efficiency did not further increase. He (Professor Hopkinson) did not quite follow him there. He did not think there was any evidence in the paper showing that there was any departure from the law (if it might be so called) that efficiency did not go up with compression. Anybody who worked gas-engines knew the best efficiencies were not obtained when using the heaviest charge. On an engine he had worked with, when the charge was (say) 0·1 cubic foot, the efficiency was about 37 per cent.; when the charge went up to 0·13 cubic foot per explosion the efficiency fell to about 35 per cent. This result, which was well known, could, he thought, also be predicted from theoretical considerations. Speaking of the effect of high compression in the paper, Professor Burstall said: "The gas is confined in a space 16 inches in diameter, at the highest compressions about 3¼ inches long, and at the lowest compressions about 6½ inches long; the gas being entirely surrounded by water-cooled surfaces. This being the case, the leakage of heat during compression will be greater proportionately at the high than the low compressions, because the higher compression is accompanied by a higher density and by a temperature difference between the walls and the charge; and this more than compensates for the reduction of the area of surface exposed to the gases. Hence, after some definite compression is reached, further compression will result in a loss of economy and not a gain." These passages would indicate Professor Burstall's view that the lower efficiencies he thought he obtained by increasing the compression were due in some way to loss of heat. The effect of loss of heat, however, during the compression of the charge was really very small indeed.

There were two or three other speakers. An expression of regret was made that ignition did not take place under different compressions at an exact point. Here they had ignition taking place at various points of the stroke; and it was impossible to compare the one with the other, and arrive at any definite conclusion. Another criticism was that there was nothing to show what mixture was being used; and it did not appear that the same mixture was used for every charge. Professor Burstall was also asked whether he had any definite means of determining the point of ignition. It was further suggested that there might be some lag in the igniting apparatus, which might make the ignitions appear earlier than they actually were. It was also mentioned that Professor Burstall still ignored mechanical efficiency. The gas-engine, it was submitted, was essentially a prime mover; therefore, it was asked, why ignore mechanical efficiency? It was suggested, too, that the results in the report and the previous

one were not comparable, because in the latter coal gas was used, and in the present one producer gas.

Professor BURSTALL, in his reply, said the criticism was much less than he had expected. He could have criticized himself far more than any of the speakers had done. It had been suggested that they might have done better with the engine if they had fired the charge later. But he might say the engine had been experimented on for three years by all sorts of gentlemen; and he thought those present might conclude that they had found the best way of driving their own engine. As to the point regarding brake horse power, all scientific investigation must be done on the indicated horse power. If, however, he was carrying out a commercial investigation for a client, to find the best engine for a certain purpose, he should not trouble about the indicated horse power, but should look after the brake. He also mentioned that he had, in the earlier stages of his experiments, had premature ignition; and he had taken out pieces of carbon quite $\frac{1}{8}$ inch thick, which could never have been formed at 200° C. These pieces of carbon must have been exposed to 500° or 600° C.; and they were due to incrustation.

Hearty thanks were accorded Professor Burstall for his interesting and instructive report.

REGISTER OF PATENTS.

Treatment of Coal Gases to Recover Tar and Ammonia.

FELD, W., of Hoenningen-on-Rhine, Germany.

No. 29,752; Dec. 31, 1906.

This invention has reference more especially to the process described in patent No. 26,262 of 1905. It has for its object "to extract, in a satisfactory and efficient manner, ammonia in the form of ammonia salts—such, for instance, as sulphate of ammonia or chloride of ammonia—from gases containing ammonia."

Hitherto, says the patentee, such gases have been cooled to a low temperature; the ammonia being partly dissolved by the water condensed from the gases at the low temperature, the other part left in the gases after the condensation of the water having afterwards been extracted by treatment with fresh water. From the dilute ammonia liquors thus obtained, the ammonia was distilled and absorbed by acids. In order to obviate the necessity for this distillation process, the gases have been treated with sulphuric acid at such a temperature (usually above 70° C.) that practically no water is condensed in the acid bath, and the sulphuric acid is not diluted. But the resulting sulphate of ammonia is contaminated with tarry matters and contains sulphur, sulphuric acid, and other impurities.

According to the present invention, the ammonia is extracted from the gases by treating them with a liquor containing a calcium salt (held entirely in solution, or partly in solution and partly in suspension)—such, for instance, as chloride of lime, sulphate of lime, and the like. The impure sulphate of lime, as it occurs in Nature—and known in the trade as gypsum—may be used, and also the sulphate of lime obtained in many industries as a bye-product.

If this treatment were effected at a temperature above 70° C., the reaction would be slow and incomplete; and if it were effected after the gases have cooled to under the dew-point of the water in the gases, the resulting solution of ammonia salt would be so diluted that distillation and absorption in acids would be necessary to obtain concentrated ammonia products. The patentee therefore subjects the gases to a preliminary treatment, whereby the tar and the water are first removed in such a way that practically no ammonia is condensed with either the tar or the water; and he then effects the extraction of the ammonia from the gases (from which the tar and water have been thus removed) by treating the gases with a liquor containing a calcium salt. By the simultaneous reaction of the ammonia and the carbon dioxide in the gases upon the calcium salt, the corresponding soluble ammonia salt and insoluble carbonate of lime are formed. To complete the reaction, the gases must contain for each two molecular proportions of ammonia at least one molecular proportion of carbon dioxide. Should the gases contain an insufficient proportion of carbon dioxide, the proportion may be increased by passing air into the retorts in which the coal is distilled, or water gas, or gases of combustion, or other gases containing carbon dioxide, may be added to the gases to be treated; also the gases containing carbon dioxide may be subjected to the action of the liquor containing the calcium salt.

The following is given as an example of how the invention may be carried into effect, using impure sulphate of lime (gypsum): The gases are first subjected to treatment as described in patent No. 26,262 of 1905, whereby the tar and water are removed without absorbing ammonia. In order to get a concentrated solution of sulphate of ammonia, 300 parts, by weight, of finely ground sulphate of lime are mixed with 700 parts, by weight, of water; and the gases are treated with this liquor, containing the sulphate partly in solution and partly in suspension, after the tar and water have been removed. This treatment may be carried on in any suitable washing apparatus. In order to extract all the ammonia and use practically all the sulphate of lime in the absorption process, at least two such appliances should be used, or one apparatus with at least two chambers can be employed—the first chamber containing the nearly saturated solution of sulphate of ammonia, and the second chamber containing a fresh quantity of sulphate of lime held partly in solution and partly in suspension. The apparatus it is preferred to use is that described in patent No. 11,206 of 1905, containing several superposed chambers or receptacles.

The fresh liquor containing sulphate of lime—partly in solution and partly in suspension—enters at the top, and the solution of sulphate of ammonia containing the precipitate of calcium carbonate, together with any insoluble impurities contained in the sulphate of lime, leaves at the bottom. The gases pass through the apparatus in the opposite direction to that of the liquor. By this treatment all the ammonia is said to be absorbed, and the saturated liquor, containing about 20 to 25 per cent. of sulphate of ammonia, is separated from the precipitate of carbonate of lime and evaporated to dryness. The resulting sulphate of ammonia is neutral and practically free from impurities. The carbonate of lime can be washed with water, and the washing liquors, containing dilute sulphate of ammonia, can be used instead of water, for mixing with the ground sulphate of lime, and thereby a more concentrated solution of sulphate of ammonia is obtained.

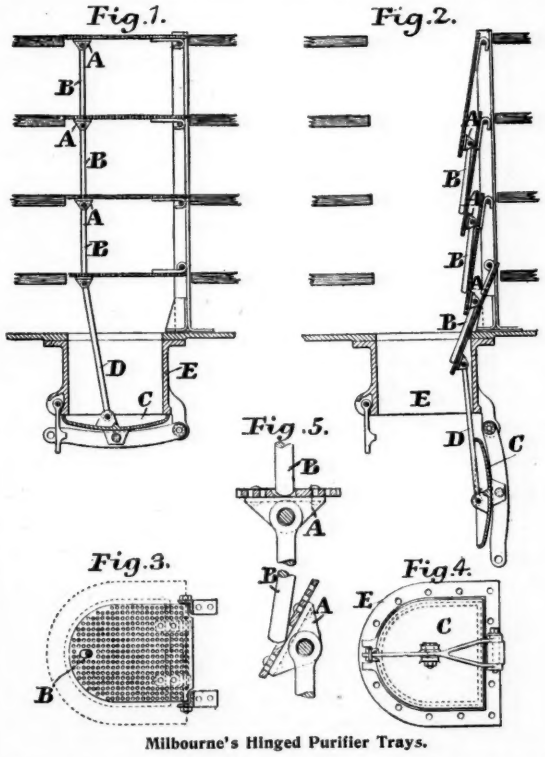
The patentee refers to his prior patent No. 26,262 of 1905, and says he is aware that it has already been proposed to remove ammonia from coal gas by passing the gas over dry calcium salts; but what he claims as his present invention is: 1. The process of extracting ammonia from gases, which consists in first subjecting such gases to treatment by which tar and water are removed therefrom, and then effecting the extraction of the ammonia from the gases by treating them with a liquor containing a calcium salt other than calcium nitrate—such, for example, as sulphate of lime, or gypsum, or chloride of lime. 2. The process of extracting ammonia from gases produced from materials which are such that the gases contain less than one molecular proportion of carbon dioxide to two molecular proportions of ammonia; the process consisting in introducing air into the distilling retorts, and then first treating such gases so as to remove the tar and water and then effecting the extraction of ammonia from the gases by treating them with a liquor containing a calcium salt—such, for example, as sulphate of lime, or gypsum, or chloride of lime. 3. The process of extracting ammonia from gases, produced from materials which are such that the gases contain less than one molecular proportion of carbon dioxide to two molecular proportions of ammonia; the process consisting in first subjecting the gases to treatment by which tar and water are removed, and then effecting the extraction of ammonia from the produced gases by subjecting them to treatment with a liquor containing a calcium salt—such, for example, as sulphate of lime, or gypsum, or chloride of lime—together with gases containing carbon dioxide.

Discharging the Contents of Superposed Chambers, Trays, Sieves, or the like—more especially intended for use in connection with gas purifiers.

MILBOURNE, R. J., of Muxton, near Newport.

No. 1389; Jan. 18, 1907.

The object of this invention is to provide easily operated devices for discharging the contents of superposed chambers, trays, sieves, or the like, such that while the portions thereof through which the material is discharged ("trays") when in their closed position constitute parts of the floors of the chambers, they, when opened, leave a clear discharge passage, supported by, or connected with, each other and with the discharge door or cover, in such manner that the trays open when the discharge door or cover is opened and cannot be closed



Milbourne's Hinged Purifier Trays.

unless it is shut. Therefore the discharge door has to be shut before the trays can be properly charged, "and dangerous escape of gas, and explosions, which would be liable to occur if the door or cover were left open, are prevented." The devices referred to are more particularly intended to be employed in connection with gas-purifiers with superposed sieves or grids for supporting the purifying material.

Figs. 1 and 2 are vertical sections of sufficient of a purifier to illustrate the invention. Fig. 1 shows the parts in the closed position, and

fig. 2 in the open position; fig. 3 is a section of fig. 1; fig. 4 is a plan of the underside of the door; and fig. 5 shows parts of the devices (to a larger scale) in the shut and opening position.

The three upper trays shown are hinged at one side to centres preferably consisting of rods secured to angle bars, over which are passed hooks attached to the trays, which will allow of them being readily removed and replaced when desired. At or towards the other side, the underside of each tray is provided with a bracket A, to which is hinged a strut B, which rests upon the upper surface of the tray beneath, when the trays are in their closed position (as fig. 1). The ends of the struts are preferably rounded and rest in a recess in the tray beneath, which recess has preferably one side vertical, so as to give a firm support when the trays are closed. The other side of the recess is inclined, so that the struts will easily be released when the trays are opened on the discharge door C being opened. The lowermost tray is supported by, or connected (preferably permanently) with, the discharge door by a strut or rod D, hinged at one end to the bracket on the lowest tray, and at the other end either resting on the door or connected to it by being hinged to the bracket on the door. The hinge of this lowermost tray is preferably a permanent one. When the discharge door is closed against the discharge spout or mouthpiece E, the lowermost tray is closed, and is supported closed by the rod D connected with the door C; and the other trays are successively similarly closed and supported by their respective struts B resting in the recess in the tray beneath.

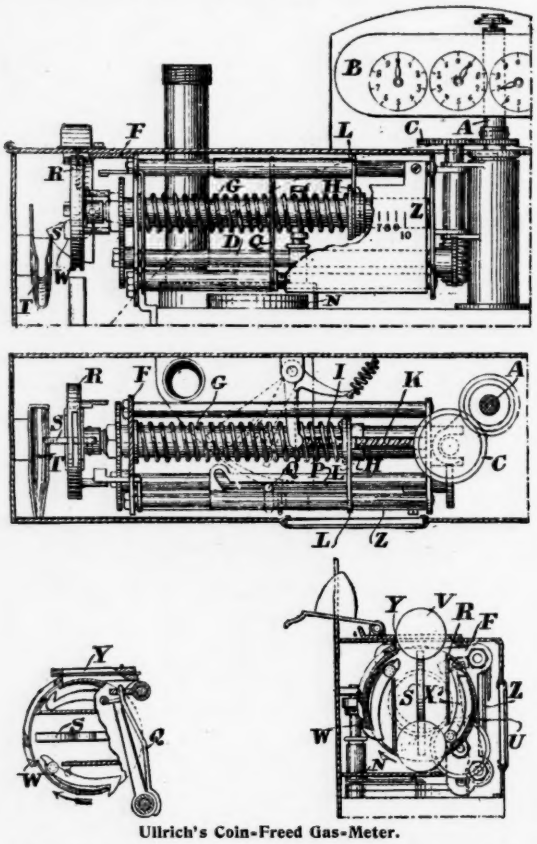
When the discharge door is opened, the lowermost tray is opened with it, by reason of the connection between the door and the tray; and the trays above open as the trays beneath leave the position in which they support the trays above. Thus a clear discharge passage is left (as fig. 2). After discharge, the trays cannot be closed until the door C is closed and the trays from the lowermost upwards are also closed and their struts in position, as the closed door and trays respectively are the only means by which the trays above are supported. The hinged sides of the trays and the discharge spout or mouthpiece and door at the corresponding side are formed straight across their width, so that when open they lie well back to leave the discharge openings free and give a sufficiently clear passage.

Coin-Freed Gas-Meters.

ULLRICH, R., of Berlin.

No. 7065; March 21, 1907. Date claimed under International Convention, March 22, 1906.

This coin-freed mechanism for automatic delivery apparatus consists of a coin-drum controlling the delivery released from its locked position by a coin introduced with pressure; two or more pawls being pivotally mounted in the coin-drum and co-operating with fixed stops on the casing—the pawls being successively disengaged from their stops by the introduction of a coin into the coin-drum and being thus free to rotate a distance depending on the number of locking pawls employed.



Ullrich's Coin-Freed Gas-Meter.

The illustration shows a front elevation, a plan, and a side elevation of the gear; also, the coin-drum closed after the introduction of the last coin which the apparatus can receive in direct succession.

In the hollow spindle G is rotatably mounted a spindle K, provided with a quick-pitch screw-thread and carrying the coin-drum R; the nut I of the spindle being guided by arms in longitudinal slots in the hollow spindle. On the spindle is mounted a spring with a ring H resting against the arms of the nut, and which ring, when moving on the hollow spindle, drives, by means of a yoke L, a slide sliding on a bar of the frame. Parallel to the spindle G is mounted a second spindle D, the movement of which is transmitted to the former by two interchangeable toothed wheels. The driving of the spindle D is effected from the spindle C transmitting the movement of the counting mechanism B by means of toothed wheels, worm, and worm wheel.

During the rotation of the spindle G by the counting mechanism—that is to say, during the consumption of gas—the spindle drives the nut I, and the latter then advances in the longitudinal direction on the screw spindle K, which is held fast by the coin-drum R locked to the casing. In this way, the spring shown is compressed until finally the ring B strikes an arm of the gas supply-valve N and moves it into the closing position. The flow of gas is thus interrupted; the meter rendered inoperative; and the spindle G, with the nut I, stopped. By the introduction of a coin into the coin-drum R, the latter is unlocked from the casing. The spindle K can therefore rotate, and will do so, as the nut I is forced towards the right by the compressed spring. But the nut can only move longitudinally in the slots of the hollow spindle G, which is held fast by the measuring gear, but cannot rotate. The arm, which is then released, is drawn back by the spring, so as to open the valve N.

The release of the coin-drum can be effected consecutively until finally an arm Q slides into the steep portion of the slot P in the slide, and thereby places a second arm, connected to it, into the path of stops on the coin-drum. The latter is thereby held fast in a position closing the coin slot Y, until, owing to the return movement of the slide during the discharge of the gas, the arm Q has been brought back to its initial position.

The number of the coins inserted in excess of the gas actually supplied is indicated on the scale Z by means of an index secured to the cross beam L.

The coin-drum R is provided with two opposite locking pawls similar to those hitherto operated by the weight of a falling coin, but which, according to this invention, are adapted to be disengaged by the coin inserted with pressure. These pawls are normally forced by springs away from the periphery of the coin-drum, and held within reach of a stop W. The pawl which is situated at the time behind the stop W is moved out of reach of it by the coin V, of a given diameter, introduced through the slot Y of the gear casing into the coin-drum, so that the drum and screw spindle K can be rotated by the nut I. During this time, the coin fixed in the drum by means of the pawl is driven and held in position until it is pushed out of it by the next following coin by means of a tongue S freely movable in the coin-drum, and falls through the shoot T into the coin-box placed below.

Coins of incorrect dimensions cannot raise the pawls at all, or not to a sufficient extent; and therefore, after expelling the preceding coin, slide over the tongue S into a second shoot, whence they can be discharged into a special box or outside. The coin introduced last can be forced out by depressing the tongue S by means of a closing device of the coin-slot Y, projecting into the coin-drum R.

If the coin is not released after being introduced, but pulled back again, then the pawl, which may have been brought out of engagement with the stop W, springs behind, so that the coin can be again introduced—the coin-drum being slightly turned back, owing to its coin-slot not corresponding exactly to the coin introduction opening. If, however, the release be effected by any other means than a coin or disc of suitable size, then the pawl springs behind a third stop, and is held fast in position, closing the introduction opening V so that, after the quantity of gas paid for has been used, the meter is rendered inoperative, and can be rendered operative again only by putting the coin-drum right by some person familiar with the apparatus.

Producing Gas for Use in Gas-Engines.

BELLAMY, H. M. & A. R., of Stockport.

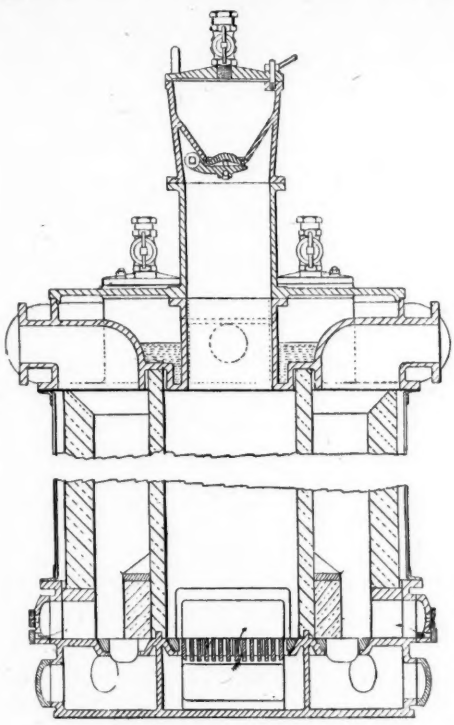
No. 7076; March 25, 1907.

This invention relates to the manufacture of producer gas from bituminous coal, instead of anthracite or coke. When bituminous coal is used, it has been proposed to pass the gases resulting from distillation through incandescent carbon, with a view of converting the tar-producing gases into permanent gases; and this has been attempted in a variety of ways. But, according to their invention, the patentees propose to produce such gas by a method involving the use of three retorts or chambers to form a complete generator—the main chamber or generator being so combined with the other two auxiliary retorts or chambers that the latter chamber can alternately act as reducing and distilling chambers.

The system of working is an alternating one. The gas produced in the main chamber or generator is passed into one of the other auxiliary chambers or retorts, which second chamber at such time contains incandescent coke and acts as a reducing retort, and also serves to convert the tarry gases into permanent ones; while the third chamber at the time acts as a distilling retort or coking furnace, distilling the contained bituminous coal to the condition of coke. At the required time, the third chamber can in succession act as the reducing chamber, while the second chamber is emptied, re-charged, and brought into use as the distilling chamber. The construction of the complete generator is such as to cause the heat from the main chamber or generator to distil the volatile matter from the contents of the distilling chamber; the heat from the main chamber also partly serving to keep the column of fuel in the reducing chamber sufficiently hot for reducing purposes. Thus the heat of the main chamber or generator is usefully employed and serves a dual purpose, and provides in succession hot columns of fuel from which the volatile constituents have been distilled, with the result that there is available a succession of reducing chambers or columns of coke where the carbonic acid from the main chamber or generator is reduced to carbonic oxide, and where also the products of distillation from the coal in the distilling chamber are passed through, together

with the tar-containing gases from the main chamber, and are converted into permanent gases, "giving a constant production of gas."

In one form of producer or generator, the patentees use a concentric arrangement consisting of three separate and distinct chambers divided by walls of suitable material. The main chamber or retort producing the bulk of the gas is centrally located, and the other two chambers (No. 2 and No. 3) lie around, or partly around, the central chamber, so as to pick up or utilize the heat therefrom. There is a system of pipes to permit of the combining of the three chambers in the fashion already referred to.



Bellamy's Gas Producer.

The main or central chamber has a grate or bars of appropriate design, and is charged with fuel through the doors or openings. A supply of air or steam, or both, is given below the grate or elsewhere; the coal being burnt just as in an ordinary Dowson generator to produce gas of approximately the usual composition together with the gases distilled from the coal. One of the other chambers or retorts (say, No. 2) is, on the initial start, filled with coke, and the other chamber (No. 3) with bituminous coal. The fuel in chamber No. 2 is ignited, and sufficient air is supplied to render it incandescent; and to this chamber the gas from the main or central generator is forced or drawn. The incandescent fuel in this chamber serves to convert the volatile matter distilled from the main chamber into permanent non-tarry gases, the column of hot coke also acts as a reducing agent and reduces the carbonic acid in the producer gas to carbonic oxide. The gas distilled from the fuel in chamber No. 3 also passes to chamber No. 2, containing the coke, and is similarly acted upon; the resulting gas from chamber No. 2 being taken by a pipe, arranged below the grate or elsewhere, and conveyed to the scrubber or other cleaning appliance and then to the engine.

The main generator radiates sufficient heat, combined with the heat from the fire consuming the fuel or coke in No. 2, to keep the fuel sufficiently hot to act as a reducing agent. While this action is taking place, the coal in chamber No. 3 is being distilled; and, by the time the fuel in the second chamber is becoming spent and insufficient in depth for the reducing process, the fuel in the third chamber is sufficiently coked for the change to be made. Chamber No. 2 is now cut-off, by manipulating a valve or valves, and the gases from the main chamber are conveyed to chamber No. 3, and are caused to pass through the coke in it, which has first been rendered incandescent—it being understood that the gas for passing on to the scrubber is now collected from below the grate of chamber No. 3, and the valves on the collecting pipes operated to this end. Chamber No. 2 is now cleaned out and recharged with coal. When this is done, the chamber is cut in again and the fuel slowly distilled; the gas produced being taken on and combined with that passing from the inner or central generator and introduced into chamber No. 3. This represents the whole cycle of working.

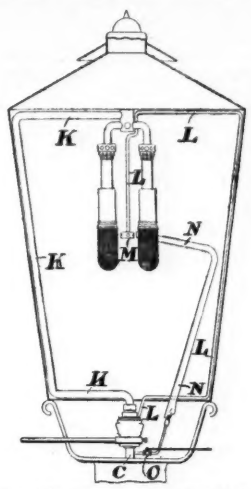
Inverted Incandescent Gas-Burners.

GRAETZ, M., of Berlin.

No. 8744; April 15, 1907.

This invention relates to incandescent gas lights, which, in known manner, are provided with a supplementary pipe or tube starting from the main gas supply, leading to an ignition-head arranged near the mantles of the lamp, and adapted to ignite the main flames by means of a supplementary flame. It is the object of this invention to ignite the supplementary flames by means of a device arranged with its lower end at or near the gas-tap, and led from there in an upward direction with its upper end in the proximity of the ignition-head for the purpose of igniting the supplementary flames. At the lower open end of the tube (the "ascension pipe"), an ignition-tube discharges, branching from the main gas supply or gas-tap as desired.

The operation of the device shown is as follows: The supplementary pipe L is in communication with the gas supply C. By turning the casing of the plug, the gas-pipe K is connected also with the main conduit, and gas passes simultaneously to the burners and mantles and the ignition-head M. By opening the cock O, gas flows into the ascension tube N, and supplies the latter with gas. If, after a short time, the gas discharging from the pipe O is ignited, the gas in the interior of the



Graetz's Incandescent Gas-Lamp.

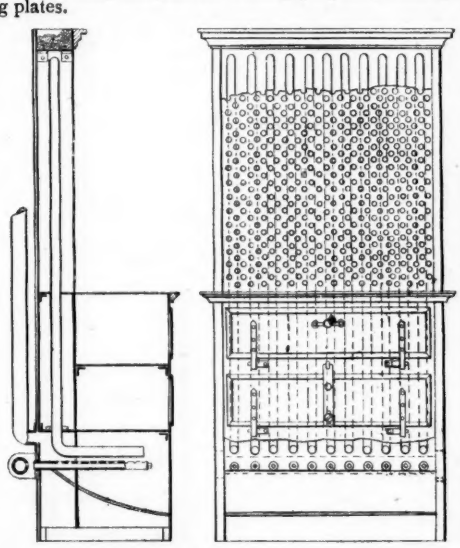
tube N will also be ignited, and the flame rises gradually in the interior of the tube and ignites the gas discharging from the ignition-head M; and the supplementary flames ignite the main flames of the lamp. The ignition of the supplementary flame will not take place by the flashing-back of the ignition flame; but the flame produced by the ignition of the gas at the lower end of the ascension pipe rises gradually in the interior of the latter and ignites the gas discharging from the openings of the ignition-head, "so that any injurious action which perhaps might happen in using a flashing-back flame is entirely avoided."

Gas-Stove.

WEBER, G., of Singen, Germany.

No. 10,655; May 7, 1907.

This gas-stove, for heating purposes (and which can be provided with an arrangement for cooking), consists essentially in the arrangement of a number of jointless steel tubes, bent at right angles, of which the vertical longer arms are enclosed in a casing of sheet metal, while the horizontal and shorter arms are heated by bunsen burners. The gases of combustion are carried away by an outlet tube or flue; so that only the heat radiated from the steel tubes heats the air in the room. The heat generated can be further utilized by conducting it to one or more chambers preferably arranged above the horizontal and adjacent to the vertical branches of the tubes, so as to be heated on two sides—these chambers being designed for cooking purposes, heating food, or warming plates.



Weber's Gas-Stove.

The casing, as shown, made of sheet steel or the like, encloses in its lower part a combustion chamber, into which the horizontal branches of bent jointless steel tubes are introduced. A horizontal wall separates the combustion chamber from the upper part of casing, the front of which upper part is constructed so as to form a chamber for the purpose of cooking or heating food or warming plates (heated by tubes and

combustion gases coming from the burners), while the back part forms an enclosure or channel for the heating-tubes. Holes are provided in the back wall of the casing so as to allow the air to be heated to flow to the upper parts of the heating-tubes, from which it reaches and heats the room, passing through in perforations the front wall of the casing.

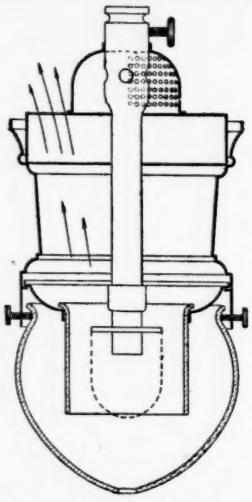
Inverted Incandescent Gas-Burners.

REISS, C., of Berlin.

No. 15,776; July 9, 1907. Date claimed under International Convention, May 18, 1907.

As shown, this inverted incandescent gas-lamp has the outlet for the combustion products arranged opposite the air inlet; and a draught chimney for the combustion products operating in a particular manner to be described.

The top cover or the plate of the casing is provided with an opening through which the combustion gases escape, and where the ignition of the gas takes place. To the top of this cover a protective bell-shaped cap is attached surrounding the ignition chamber of the mixing-tube.



Reiss' Inverted Gas-Burner Lamp.

This cap is closed at the side turned towards the opening; whereas at the opposite side it is provided with a number of perforations. The openings in the mixing-chamber, in combination with the holes in the cap, allow for the entrance of a constant current of fresh air into the mixing-chamber as the lamp is burning.

After the lamp is lit, the hot combustion gases issuing from the lamp will rise and escape through the opening at the top. Due to the extended distance between the top edge of the glass cylinder round the mantle and the top plate, this exhaust of the combustion gases produces a draught, which, in turn, creates a sucking action within the mixing-tube, and thereby increases the velocity of the flow of the incoming gas, as well as the stream of fresh air, passing through the holes in the cap and the hole into the mixing-chamber. Inasmuch as the air-inlet holes are situated opposite the exit opening for the exhaust gases, the latter cannot lave around them and throttle or prevent the free flow of the fresh air current through the inlet holes. The lamp is lit in the usual manner by bringing the igniting flame near the exit opening; and on account of the protective cap being closed on the side facing the opening, it is impossible for the ignition flame to reach the out-coming gas at the nozzle within the mixing-chamber and cause ignition there.

APPLICATIONS FOR LETTERS PATENT.

245.—FARLEY, J., "Compressing and igniting gas." Jan 4.
252.—JOHNSTON, J., "Gas-producers." Jan. 4.
314.—DRISCOLL, R., PECKOVER, S., and SCRIVEN, C., "Treating coal." Jan. 6.
350.—TURNER, F., and HANDS, G., "Inverted burners." Jan. 6.
391.—STOTT, J., "Incandescent lamps." Jan. 7.
410.—HEDGES, K. W., "Gas heating-stoves." Jan. 7.
436.—CARTAULT, P. J., and LEMOINE, A. F., "Water-meters." Jan. 7.
514.—APFELBAUM, J., "Securing globes." Jan. 9.
518.—HARVEY, W. H., "Room-warming attachment for gas-burners." Jan. 9.
572.—WILLIAMS, H. W., "Gas-purifier." Jan. 9.
694.—SMITH, C., "Controlling the gas supply to incandescent burners." Jan. 11.
710.—BRITISH CYANIDES COMPANY, LTD, and ROSSITER, E. C., "Purification of coal gas." Jan. 11.
714.—LENDNER, A. E. W., "Lighting and extinguishing gas-lamps." Jan. 11.

Suicide by Gas.—At Barking, Edward Hopkins, aged 50, committed suicide by putting a coat over his head and tying round his neck an india-rubber tube communicating with an open gas-pipe. He went to a neighbour, and gave her a penny to put in the meter, saying he would be glad for her to come in and boil some water early the following morning. She then went away for the night; and on her return next day, found the deceased dead, as described.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Mr. Ernest Körting on Carbonization.

SIR,—In perusing Mr. Ernest Körting's very interesting article in your issue of the 14th inst., I notice the following statement in Paragraph 5: "The other way—very high heats, considerably higher than those necessary for the thin layers in the horizontals—which would lead to a large production of gas, is not practicable because of the rapid destruction of the setting."

This statement as to the rapid destruction of the setting is scarcely in accordance with experience at the writer's works, where heavy charges (so called) have been in practice for many years; from 840 to 1000 cubic feet per foot of retort, with a sectional area of 21 in. by 15 in., being the usual production, and the life of the setting ranging from 6 to 10 million feet per retort under normal conditions. The lower figure was obtained with improved direct-fired settings. A temperature of 2000° Fahr. in the retort at the time of charging has been found quite sufficient for the above result.

It has probably been the case that in the past, in the designing of retorts, too much attention has been given to the charging area—*i.e.*, the retort has been designed to suit some charging or drawing machinery, with only little regard to its carbonizing capacity, with a consequent waste of room in retort and setting, and bad carbonizing results—and to the practical carbonizer the question arises, Why put in a retort of a sectional area of 22 in. by 16 in. (the usual area), if you cannot obtain a greater production than from a circular retort of 16 inches diameter?

Apparently, what is required is a larger generator, producing a greater bulk of gas, but not necessarily using a greater proportion of fuel per unit, to obtain a proper production for the larger retort. It is now an acknowledged fact that ideal carbonization is only obtained in a full retort. With proper attention to this, and due regard to condensation, half the troubles of gas managers will disappear.

Dorking Gas-Works, Jan. 18, 1908. S. CARPENTER.

LEGAL INTELLIGENCE.

DISPOSING OF THE WATER FROM GASHOLDER TANKS UNDER EXTENSION.

Last Thursday, at the Tower Bridge Police Court, before Mr. CECIL CHAPMAN, the proceedings in the case of the "Lewisham Borough Council *v.* South Suburban Gas Company" were resumed. The matter had been before His Worship on two occasions at the Greenwich Police Court (see "JOURNAL" for July 23 and 30 last). It will be remembered there had been complaint by residents of a nuisance in the nature of an offensive smell from the gas-works; and the allegation that it arose from the exposure of the water in two large gasholder tanks, and from their emptying for the purpose of adding to each a further lift. The Company, on the other hand, denied that the smell complained of arose from their works, and imputed the source to the Council's own sewers. His Worship, in view of the nature of the evidence submitted on the occasion of the second hearing, said it seemed to him essential that it should be supplemented by experts who should really try to find out whether the smell did exist, and whether or not it came from the sewers. Personally, however, he thought that there was no tracing it to the sewers. He, however, considered that the matter should be carefully watched for a period, and be brought again before him. The proceedings were then adjourned *sine die*, and were reopened last Thursday.

Mr. A. H. POYSER appeared for the Borough Council; Sir CHARLES MATHEWS for the Company.

At the outset of the proceedings, there was a discussion initiated by Sir Charles Mathews renewing the objection he took at the commencement of the second day's hearing—that section 21 of the Public Health Act, 1891, only applied in the case of an alleged nuisance in existence at the time the proceedings were taken. The wording of the section, he submitted, was entirely in the present tense, and did not refer to anything that had existed, but to something that was existing at the time proceedings were taken. He quoted the sub-sections in support of his contention; and suggested that the matter should have been raised under section 4 [Notice requiring Abatement of Nuisance] and section 5 [On Non-Compliance with Notice, Order to be Made]. Reply was made by Mr. Poyser; and His Worship closed the discussion by saying that personally he could not see how ten inhabitants could wait and find out whether the time for making complaint had arrived, and gradually get together, and make their complaint without a little delay; and it did not appear to him that the section intended that a person who had committed a nuisance should escape scot free.

Mr. POYSER said he should like to say a few words as to the position in which the case was left on the last occasion. They had two days' sittings; and he ventured to think that it would be an advantage if they had the evidence read over before he called rebutting evidence. With regard to the rebutting evidence he was going to put before his Worship, it would come under two heads, first (assuming his learned friend was right as to this nuisance being merely of a temporary nature), on the last occasion it was suggested that it arose from some structural alterations to two gasholders; and, regarding that, he (Mr. Poyser) proposed to put evidence before the Court to show that, in the mode adopted by the Company, they did not take the best practicable means of avoiding the nuisance—that they could have carried out the work in such a way as to prevent disturbing the water which

they said was the cause of the nuisance. Under the second head, he should submit that they could have so treated the water as to render it innocuous. He should call experts to give evidence on these two grounds. Then there was a suggestion by his learned friend and the Gas Company that the smells arose from the sewerage system. The Borough Council had taken considerable pains to obtain the proper material to put before the Court to show the exact system of the borough sewers; and he should show, by the evidence of their Surveyor, that it was extremely improbable that the drains could have had anything to do with this nuisance.

His WORSHIP said the impression left on his mind was that the smell was not due to the drains. His recollection was that the smell arising from the gas-works was of a particularly acrid sort of character which would not arise in the ordinary way from the drains. This being so, the question was to find out whether the smell was likely to occur again; was it due to the gasholders; and whether in the clearing out of the holder tanks the best means were adopted to prevent a nuisance.

Mr. POYSER remarked that he had no evidence of the nuisance having recurred since the last hearing. However, if he proved his case, he must ask for a penalty to be inflicted, so that the Company might be cautioned; and on another occasion they might call the Council into consultation before taking any serious steps of this sort, which they, as gas experts, ought to know would cause a nuisance.

The notes of the evidence of Mr. Shoubridge and Mr. Carpenter given on the last occasion having been read,

Mr. *W. J. Atkinson Butterfield* was examined by Mr. POYSER. He said that, from the description of the smell given by the witnesses, he had formed the conclusion that it must have emanated from the gas-works, and that it was something altogether different from the normal smell associated with gas manufacture. The normal smell from a gas-works of the size of those at Lower Sydenham would never, under the most favourable conditions of wind, extend more than ¼ mile from the works. Very rarely indeed it extended to that distance, and then it would be slight, and scarcely detectable. But the smell in question evidently extended further from the works, and was of a particularly acrid and nauseating character. He also formed the conclusion, from the description of the smell given by the witnesses, that it could not be due to sewer gas; that it must have been a smell from the gas-works. He was led to this view by one or two of the witnesses identifying the smell with that of which complaint was made in 1904, when there was another nuisance case at the same works. He therefore concluded there must have been some operation at that time at the gas-works of an abnormal character, and that, even regarding it as abnormal, practicable precautions that might have been taken to avoid the nuisance could not have been taken at the time. He visited the works on July 24, and saw the gasholders in question. Some brick-making was going on at the time of his visit. That was not an operation essential to gas manufacture, and it produced an objectionable effluvium; but he did not think the effluvium complained of arose from that. When he saw the tanks, the water had all been removed; and there was practically no smell from them. The object of withdrawing the water from the tanks was to add to each holder an additional lift. He believed such operations were conducted without drawing off the water; and there were many objections to it from the economical point of view, as well as the nuisance point of view. It was a constructional matter as to how to make an enlargement without drawing off the water; but it was done, and actually an eminent firm of gasholder builders had taken out a patent for the purpose. This patent was dated as long ago as 1897. It was "for enlarging gasholders by enabling the operation to be carried out without emptying the tanks of the water." The disturbance of the water would be likely to cause a nuisance in the neighbourhood. He thought the water should not have been withdrawn; and the withdrawal should have been avoided for four reasons. The original intention of the Company was to deal with only one holder; and one of the reasons why they should have refrained from drawing water from the first tank was that it would be liable to provoke leakage from adjoining tanks. Actually, in this case, it was found that the adjoining tank would be unsafe if the water was left in it; and therefore the Company had to go on and deal with the second holder. If they had refrained from drawing water from the first tank, they could not have been compelled to proceed then with the extension of the second one. The second reason was that the withdrawal was a considerable waste of water. Roughly, he should say, the tanks in question must have held 3 million and 4½ million gallons of water respectively; and the value of this, at 9d. per 1000 gallons, would be about £100 in one case and £150 in the other. It was therefore less costly to retain the water.

His WORSHIP: What I am concerned about is rather the avoidance of nuisance than the avoidance of expense.

Witness (proceeding) said the third reason was that the residue left in the tank, as with the water, could not be removed without causing a considerable nuisance. Fourthly, the residue left in the tank was highly inflammable and dangerous; and in one of these holders it proved to be so, in that a fire occurred and damage was done. Explaining why it was the water became offensive, he said that as soon as gas was put into a holder, the water became very rapidly impregnated with certain constituents of the gas, and then a thin film of an oily nature formed on the surface of the water. The exact character of this film and its thickness depended upon the nature of the gas stored in the holder. If it was only coal gas, the film was thin and relatively unobjectionable; but if carburetted water gas was stored in the holder, it would not be a film, but a layer of oil. He understood that carburetted water gas had been stored in the holders in admixture with coal gas for some years, and up to, he understood, within eighteen months of these proceedings. The layer of oil deposited by the carburetted water gas would persist in the holder for a long time, probably for years. It would become rather thinner, but it would remain and it would retain its penetrating and potent smell.

Sir CHARLES MATHEWS: It diminishes with time?

Witness agreed. Taking this into consideration, he estimated that the thickness of the layer at the time the holders were opened must have been ⅛ to ¼ inch thick. Taking the lower figure, he estimated that ⅛ inch meant, when spread over the area of these two tanks, in the case of one 1150 gallons of the oily stuff, and in the other case 1350 gallons—that was a total of 2500 gallons of highly offensive liquid, and the greater part of it would be gradually evaporated as pumping proceeded. As the level of the water sank in the tank, the sides would be moistened, and give a larger surface for evaporation. Then at the time of the year when these operations were taking place, the sun's heat would be gradually increasing, and that would provoke evaporation; there would be gradual evaporation increasing over the whole period while the pumping continued. The smell from this stuff was a penetrating one, and would travel a long distance.

His WORSHIP: Supposing the water had not been removed from the tanks, would there not have been an effluvium from merely opening the holders and leaving the surface exposed?

Witness replied that there would have been some; but it would have been less, on account of the smaller disturbance of the water. He was coming to the point that the film should in any case have been removed. This could have been done by pumping from the surface. Instead of sending the suction pipe to the bottom of the tank, an inverted pipe could have been used, so that the water from the surface flowed over into it. This would skim the surface of the water in the tank, in the way that overflows were arranged to retain water in a tank at a constant level. The stuff (which was in the nature of a light tar) could then have been put into the tar-wells, and it would have mixed with the tar. This method of proceeding would have almost entirely prevented any nuisance. While the operation was going on, it would only have been necessary to have had a small opening in the crown of the holder.

His WORSHIP: Has that been done in any other case?

Witness: So far as I know it has not. But the number of such enlargements is comparatively few; and, in many cases, gas-works are far from residential districts.

The plan adopted in this case is the one usually adopted?—In removing the water they followed the usual plan.

Do you know if the patent to which you have referred has been worked?—I cannot name an instance. The constructional details are out of my ken.

Examination continued: By the manner in which the work was conducted, the oily layer on reaching the bottom of the tank was mixed with the heavier tarry layer there. In any case, this tarry matter would tend to block the suction pipe of the pumps used. As a matter of fact, he was informed that it was found that it choked the suction, and steam was injected to render it more liquid—to warm it, and liquefy it. The introduction of steam would tend to disseminate the odour through the air. If it was necessary to liquefy the tarry layer in order that the pumps might deal with it, it should have been done in another manner. The bottom of the tank should have been sprayed with petroleum.

Sir CHARLES MATHEWS observed that the suggestion as to tarry matter at the bottom of the tank was quite new to him.

Witness said it might have been described to him on his visit as a deposit without using the word "tarry." He was told there was a sediment of deposit which choked the pipes, and had to be steamed; and this deposit mixed with the oily film on the top. Heavy petroleum was an excellent solvent for light oil and naphthalene; and the amount of petroleum requisite for the purpose of spraying would probably have been 500 gallons, costing £25. This petroleum could then have been used for gas making afterwards, and the value thus largely recovered. He thought every endeavour should have been made to leave the water, or the bulk of it, in the tanks; and whether or not it was necessary to remove the water, the oily film should have been cleared off before the holder was thrown quite open. Further, if for structural reasons it was found impossible to do the work without removing the water, it should not have been pumped into the sewers without special arrangement with the authorities, and at times indicated by them.

His WORSHIP asked what the patent consisted of to which witness had referred, by which the work could have been performed without removing the water.

Witness said it consisted of a staging built on the framing in the holder tank; the work of putting in a new lift being carried on above the level of the staging. The water in the tank would probably have to be lowered a few feet to enable this to be done.

Cross-examined by Sir CHARLES MATHEWS: When he visited the works on July 24, he found, excepting the brick-making, everything in working order. He should say the means adopted in this case for carrying out the holder work were those adopted in the majority of cases—perhaps he might say half and half. In regard to the patent, he could not name a single instance in which it had been used for conducting such operations. He had had charge of gas manufacture, but not of constructional works. He was not a gas engineer. Asked whether the whole of his theory was built up on what he was told on the occasion of his visit, he replied in the negative. With regard to the thickness of the layer or film which he described as being from ⅛ to ¼ inch thick on the surface of the water, he based this on the fact that the layer in a holder containing carburetted water gas was from ½ to 1 inch thick. The holder contained carburetted water gas prior to eighteen months before the opening. It was true that, after that time, the gas passed into this holder was all purified by oxide of iron; but the purification would not affect the oily film to an appreciable extent. It only removed the sulphuretted hydrogen; and he did not think the smell complained of was that of sulphuretted hydrogen. He had had the control of a carburetted water gas plant in the position of which he had spoken. He was told something to the effect that the film here was one so slight that a sheet of notepaper would represent it at its thickest; but he thought that was under-estimated. Doubtless the enlargement of the holder was a work quite prudent and requisite.

Sir CHARLES MATHEWS: Were you told that the rest-stones at the bottom of the tank had to be rebuilt in order to take the new lift?

Witness: No; I do not remember being told.

Was that not requisite?—It may have been. It depends upon the original size of the stones.

How else would you suggest that work should have been done?—It depends upon their original size.

His WORSHIP: They rebuilt the stones upon which the new lift would have to rest. To rebuild would the water have to be removed?

Witness: Probably it would be necessary. But I am not sure it

would be necessary to ground the new lift at any time after it was once in operation.

What do you mean by that?—Rather than go to the expense of removing the water, I think it would have been possible to dispense with the stones in this case.

Sir CHARLES MATHEWS: Do you think that it was a requisite thing to do?

Witness: I think it probably was; but that is purely a constructional matter.

His WORSHIP: Then your first point goes. The second point is that the film might have been sucked off before the water was withdrawn, to prevent the emanation which caused the smell; and the third point is that petroleum instead of steam ought to have been used to liquefy the tar.

Cross-examination continued: Asked whether he had had any experience of skimming the film off the surface of the water by an inverted pipe, witness said he had had practical experience of separating oil and water in tar and carburetted water-gas tar-tanks, but not in gasholder tanks. The suggestions he had made had not, to his knowledge, been applied; but he thought they were reasonable.

Sir CHARLES MATHEWS: That is a concession, and here are counsels of perfection then by you which you have never known practically applied by anyone.

Witness said perhaps he might be allowed to say that the necessity for them had only arisen of late years. Carburetted water gas was only introduced into this country, he believed, as late as 1891; and it had only come into general use comparatively recently. The introduction, it was true, was sixteen years ago; but the necessity for opening holders for carburetted water gas would not arise until they had been in use for some time. He believed his inverted suction-pipe would draw the film from the whole surface, and not have merely local effect. If by any chance it only skimmed the oil off over an area of (say) 50 feet—but he saw no reason why it should stop at that distance—it would only be necessary to put the pipe in at three or four different points. The oily film was a highly fluid body; and it would spread in the thinest layer over a large expanse of water.

Sir CHARLES MATHEWS: With regard to the steam, are you dependent upon Mr. Shoubridge as to what was done by steam in the gasholder?

His WORSHIP: Perhaps we might take it Mr. Shoubridge is prepared to swear it was not done.

Sir CHARLES MATHEWS: He is, Sir, and is very positive about it.

His WORSHIP: Go into the witness-box for a minute, Mr. Shoubridge.

Mr. *S. Y. Shoubridge*, examined by Sir CHARLES MATHEWS, said that Mr. Butterfield was quite incorrect in his statement as to what he told him regarding the steaming. He (Mr. Shoubridge) did not say anything of the kind, because it never happened. The steam that was used was for blowing out the water by means of an ejector. It forced the water before it; and it was the only way that steam was used at all. There was no tarry matter to be liquefied.

Cross-examined: He probably told Mr. Butterfield that steam was used for emptying the tank, or for blowing out the whole of the water from the tank, but not for softening any sediment. The water in the tank was river water. There was a good deal of alluvial matter in it; and, when it was quiescent, the solid matter sank to the bottom of the tank.

Mr. *Butterfield* (re-examined): The film from the carburetted water gas having been formed on the water, it would not be destroyed in eighteen months—it would simply be reduced; and he allowed for that in his estimate. With regard to the question of the rest-stones, he had not gone into that minutely; seeing that it was a matter for the engineer.

Mr. POYSER here asked for an adjournment of the proceedings, as his engineering witness was suffering from influenza.

There being no objection on the part of Sir Charles Mathews, the further hearing was adjourned to a date to be agreed.

ACTION AS TO BRENTFORD GAS SHARES.

In the Chancery Division of the High Court of Justice on Saturday, before Mr. Justice Swinfen Eady, an action was brought by Mr. Barlow, the representative of Messrs. J. & G. Barlow, to obtain registration in his name of nine shares in the Brentford Gas Company.

Mr. Macnaghten, K.C., and Mr. Maugham (instructed by Messrs. Hores, Pattison, and Bathurst) appeared for the plaintiff; and Mr. Micklem, K.C., and Mr. Coote (instructed by Mr. H. E. Griffith) for the Company. Mr. Gore Browne, K.C., and Mr. Manning appeared for Mr. Galbraith, who claimed some of the shares in question.

It appeared from Mr. Macnaghten's opening statement that Messrs. Barlow were the promoters of, and contractors to, the Company; and under their contract made in 1821 they were to get £21,000 in cash and £7000 in the shape of 140 shares of £50 each, of which the nine now in question formed part. But it was arranged that these shares were to be left with the Company until 7½ per cent. was paid on the ordinary shares. This happened in 1867; and ever since then the Company had paid good dividends—averaging 11 per cent. for many years past. In 1858 the shares were converted into stock, each £50 share being represented by £58 of stock, which now stood at from £240 to £250; so that the amount was of some importance, especially as no dividend had been received by anyone on these shares. There might be a question whether any part of these dividends would be barred by the statute; but the Company did not raise this point. Messrs. Barlow having got into difficulties, it was arranged with the Company that 115 out of the 140 shares should be handed over to them. This was done in 1822; the certificates being specially endorsed. Five of these certificates the plaintiff now produced; and as to them there seemed to be no question, except as between him and Mr. Galbraith, and he had arranged with Mr. Gore Browne that on registration they should be divided between them in certain proportions. The 115 shares appeared to have been transferred by the Barlows to several of their creditors, and transfers of all but two had, at various times, extending over a long series of years, been sent in for registration. But in the case of two, this had not been done. He suggested that these two had never been handed over by Messrs. Barlow to any one, but that in some way the certificates had been mislaid or lost, and that the plaintiff was entitled to them.

On behalf of the Company, Mr. Micklem said they only desired the protection of the Court in dealing with these shares, and had given the plaintiff all the information in their power; and Mr. Macnaghten acknowledged that this was so.

After some time had been spent in examining the memoranda and minutes of the Company dealing with the matter, his Lordship ultimately decided that four of the shares were to be registered in the plaintiff's name, three in that of Mr. Galbraith, in accordance with the arrangement made; while as to the other two there must be an inquiry at the plaintiff's risk, unless, as was suggested, the Company agreed to register the shares in his name, subject to a satisfactory indemnity being given by him in case any other claimant came forward. The costs of the Company, as between solicitor and client, were to be paid in equal parts by the plaintiff and Mr. Galbraith.

THE FERMOY GAS COMPANY'S POSITION.

In the Chancery Division of the High Court of Justice for Ireland last Thursday, before the Master of the Rolls, reference was made to an action brought against the Fermoy Gas Company, Limited, as the outcome of certain troubles which have lately arisen between them and the District Council. The plaintiff was Margaret Noonan, and on her behalf Mr. Timothy Sullivan said the action was for an injunction to compel the Company to repair their mains at Barrack Hill, so as to prevent the escape of gas from them causing a nuisance to the plaintiff, as the occupier of premises situated at the part of the town named. An injunction was also sought to restrain the defendants from permitting their mains and pipes to fall into disrepair. Counsel said he had to ask for an order to issue and serve a writ on the defendant Company out of the jurisdiction of the Court. The affidavit of the plaintiff, who is a widow, showed that she lived in a tenement house, and that she was about to institute proceedings for damages and an injunction in respect of a serious nuisance arising from the escape of coal gas, due to a defective main-pipe, the property of the Company, whose registered address was at Westminster Chambers, London. The escape was almost immediately in front of the plaintiff's house, and had rendered it almost uninhabitable. Deponent had been for some time under the care of her medical adviser, and he considered the breathing of the coal gas was most detrimental to her health. The Company had no statutory or other authority entitling them to open the streets for the purpose of repairing and maintaining their pipes, and were prevented from so doing by the employees of the Urban District Council, who were trying to insist upon the Company obtaining legal authority to open the roads for the purpose of carrying on their operations. Counsel concluded by asking for the order on the grounds set forth. The Master of the Rolls characterized the application as extraordinary. He said that he could hardly understand a lady who lived in a tenement house undertaking legal proceedings. He would like to have a little more backbone to the action. Had other people not been affected? Mr. Sullivan mentioned that he had obtained an order from the Vacation Judge in a similar case against the same defendants. He was not certain whether or not his client was a householder. He did not think plaintiff's legal right would be affected by the fact that she was an occupier of a tenement house. The Master of the Rolls said Counsel might be right; but at the same time he should like him to elaborate his case somewhat. Thereupon Mr. Sullivan asked to be allowed to mention the matter again; and his Lordship assented.

AN INCANDESCENT GAS-MANTLE INTERDICT.

In the Court of Session, Edinburgh, last Tuesday, the Block Light Limited, of London, applied for an interdict against Messrs. N. Godfrey and Co., manufacturers and importers, of Glasgow, to restrain them from selling as Block mantles goods not made by the complainers. The mantles manufactured and sold by the complainers, it was said, were invented by Mr. Block; and the patent was acquired by the Company, who have widely advertised the mantles and lights—spending upwards of £20,000 per annum upon advertising alone. The action of the respondents was calculated to lead people to believe that, in purchasing goods from the respondents, they were buying those of the complainers. In August and September last, persons applied to the respondents for Block mantles, and were supplied with mantles not of the complainers' manufacture, which were represented to be Block mantles, but which were greatly inferior to them. Receipts granted by the respondents for Block mantles were produced.

The respondents denied that they sold mantles as Block mantles. On the days specified in the receipts produced, their shop-girl sold to two parties unknown to her Rock mantles, enclosed in boxes with the name "Rock Mantles" prominently displayed on the outside; and they were informed by the shop-girl that the mantles were not Block mantles. The receipts were made out in the terms stated in them, at the request of the purchasers. The respondents did not wilfully and fraudulently offer their mantles for sale as Block mantles.

For the complainers, Mr. Findlay asked for interim interdict, until the question should be tried. The respondents were not represented by Counsel; but Mr. Terry, on their behalf, offered to prove that it was Rock mantles, and not Block mantles, which they sold. Lord Guthrie said that might be done at a later stage of the action; in the meantime a *primâ facie* case was made out by the receipts, and he could not get past them. Mr. Terry asked, if interim interdict were now pressed for, why there had been such delay. Mr. Findlay explained that the delay was due to their expectation that they would get the respondent

to give an undertaking not to sell mantles as theirs. Proceedings were taken against another party, who gave such an undertaking; and the proceedings were dropped. Lord Guthrie said he could do nothing in the meantime but send the case for trial, and grant interim interdict; but, in his opinion, it was an action which ought to be settled. Mr. Findlay said the complainers would put themselves in communication with the respondents, and see what could be done.

FAILURE OF A PROMOTER OF THE KENT COUNTY GAS COMPANY.

The Official Receiver in the High Court of Justice has now issued particulars under the failure of Harry Warwick Gyde, now or lately residing at 200, Ewell Road, Surbiton, from which it appears that the receiving order was made on a creditor's petition, the act of bankruptcy being non-compliance with the requirements of a bankruptcy notice. In May, 1900, Gyde was adjudged bankrupt in the name of Henry Peter Bernard, company promoter; his unsecured liabilities then amounting to £30,000. No dividend was paid to the creditors; and bankrupt has not applied for or obtained his discharge. It appears from the statements of the bankrupt, that he changed his name, by deed poll, in 1902, to Henry Warwick Gyde. In 1902, he became associated with another person; and, until 1905, they carried on business as stock and share dealers at 119 to 120, London Wall, E.C., as "Mayward Grant and Co." They then commenced business as land agents at 5, Lothbury, E.C.; shortly afterwards taking offices at 18, Eldon Street, E C. In 1906 the Lothbury premises were given up, and they have since continued at Eldon Street. In 1906 they also started business as financiers at 119 to 120, London Wall, E.C., as Walter Scott and Co. Early in 1907 the office furniture was sold, and they removed to furnished offices at 21, Great Winchester Street, where they continued business down to the date of the receiving order. In 1907, they took offices at Parliament Chambers, Great Smith Street, Westminster, where they carried on business as financiers, as "F. C. Lawson and Co.," until March, 1907, when it was given up. Since 1905 they have promoted several public companies; the arrangements between them being that the bankrupt was to receive two-thirds, and his partner one-third share of the profits. The following are some of the companies in which the bankrupt was interested: (1) The City of London Investment Corporation, Limited, registered in or about 1903 in Guernsey, with a nominal capital of £100,000. This was simply a promoting company, of which the partners were sole Directors. It promoted two Welsh Slate Companies in 1904 (both of which are now in liquidation), but has done little other business. (2) The West Suburban Gaslight and Coke Company, Limited, registered June 22, 1905; nominal capital £30,000. The bankrupt and his partner about the end of 1904, acquired certain freehold gas-works at Colnbrook, paying about £900 for them, and expending about £1000 on the premises. They intended to work the business themselves; but "finding that there was considerable scope for development, and to obtain the necessary capital," they formed a Company to take over the business, receiving as vendors £11,000 in cash, out of which they subscribed £1000 for shares. The Company is now in voluntary liquidation for the purpose of selling the property. (3) The London and Hull Soap Works, Limited, registered Feb. 8, 1906; nominal capital £70,000. This Company was formed to take over certain leasehold and freehold properties in London and Hull, together with plant, machinery, &c., of the business of a soap manufacturer and merchant. The consideration was £38,947, of which £8500 was to be satisfied by the transfer of an existing mortgage on the Hull property, and the balance was to be paid 20 per cent. in cash and the remainder in shares. The bankrupt says that the promotion resulted in loss, and the Company went into voluntary liquidation in October, 1907. (4) Kent County Gaslight and Coke Company, Limited, registered May 2, 1906; nominal capital £50,000. The bankrupt and his associate are said to have purchased certain gas-works at Goudhurst, in Kent, for £2350, and resold the same to the Company for £21,800 cash. After discharging the expenses for formation, registration and advertisement, and subscribing and paying for 1800 shares of £5 each, the net profit is estimated at £10,000. The Company is now in liquidation, and the Official Receiver has an order for the examination of the bankrupt. The bankrupt attributes his present failure to litigation in respect of various Companies, to losses in respect of the partnership business, and to losses by speculating and by gambling. He says that books of account were kept by the partnership business, and are in possession of his partner. The scheduled liabilities comprise £180, claimed by the petitioners in respect of interest due on the mortgage on the property at Hull, belonging to the London and Hull Soap Works, and £60 for borrowed money. A proof (which the bankrupt repudiates) has been lodged by the Liquidator of the London and Hull Soap Works, for £39,974 15s. 7d., being the purchase consideration of the properties purported to be conveyed to the Company, or alternatively as damages for fraud. The bankrupt states that the household furniture belongs to his wife—having been purchased by her with her own money.

Winding-Up of Messrs. Wright and Butler, Limited.

A petition presented by Messrs. Ludlow Bros., Limited, for the compulsory winding up of Messrs. Wright and Butler, Limited, of Birmingham, came before Mr. Justice Neville last Tuesday. Mr. Galbraith said the petitioners were creditors for £352 for goods sold and delivered, and the petition was supported by other creditors. The Company did not appear to oppose the petition. His Lordship having made the usual order for compulsory winding up, Mr. Galbraith asked, as proceedings might have to be taken against the Directors, that, on the grounds of convenience and saving of expense, the Court should direct the action should be tried at Birmingham. His Lordship said if it became necessary to take proceedings, the application might be renewed at a future date.

MISCELLANEOUS NEWS.

GAS AND WATER PROFITS AT WIDNES.

No Poll to be Taken.

When recording last week (p. 114) the rejection by the ratepayers of Widnes at the public meeting of the clause in the Corporation Bill by which power was sought to allow the gas and water profits to be handed over to the relief of the rates, it was stated that the General Purposes Committee had subsequently recommended the Council to take a poll of the electors.

The matter came before the Council last Tuesday, when Mr. Lewis moved that a poll be taken. He said he could not accept the decision of the town's meeting as in any sense final. The result was achieved by the whole-hearted expounding of fallacies by gentlemen who knew better. The statement that any change in the existing system would lead to the raising of the price of gas was absolutely a fallacy; and the whole question of the price of gas was simply a matter of the Council's policy. He characterized the statement that only property owners would benefit as sophistry, and less than half the truth.

In seconding the resolution, Alderman Neil remarked that it was regrettable that such a meeting as that of a week ago should have been held. He could not call any man who attended it and voted against the Bill anything but a puppet. Mr. Smith: I was there; and I am no puppet. Alderman Neil (continuing) urged that if the Council were fit to be trusted with the sewers, schools, and highways, they were fit to be trusted with the profits of the gas-works.

Mr. Davies thought it was no use spending the £100 which a poll would mean. He was satisfied with the decision the ratepayers' meeting arrived at, though he believed that their action was a mistake, and they had voted under compulsion—the compulsion of presence, and the compulsion of the power of the eye. He would like to know who paid for the gigantic advertisement in a local paper. An official of the Corporation was credited with it; and an opportunity should be afforded this gentleman of making a disclaimer. The advertisement called him a fool—or, at any rate, said he was going to be one. It was a huge lie; and he threw it back with all the vehemence of his soul in the teeth of the man or men who concocted it.

The proposer and seconder of the motion were eventually persuaded to withdraw it; and the decision of the public meeting will therefore be final.

THE GAS-PRICE WAR IN NEW YORK.

Victory for the Consolidated Gas Company.

In the "JOURNAL" last week (p. 104), the result of the litigation which has been going on in New York in consequence of the Legislature reducing the price of gas to 80 c. per 1000 cubic feet was briefly mentioned. The current number of "Progressive Age" contains the following article furnishing particulars in regard to the dispute.

On Dec. 20, 1907, in the United States Circuit Court, Judge Hough handed down a decision which declared unconstitutional the Act of the New York State Legislature (April 3, 1906), and the order of the former Gas and Electric Commission (Feb. 23, 1906), fixing at 80 c. per 1000 cubic feet the price of gas supplied by the Consolidated Gas Company, of New York City. He upholds the report of Arthur H. Masten, Special Master in Chancery, appointed by Judge Lacombe to take evidence, and declares the law confiscatory, and therefore unconstitutional. The Public Service Commission, which succeeded the former Gas and Electric Commission, will probably take up the matter now, and in the United States Supreme Court endeavour to prove that 80 c. is not a confiscatory price. Ever since the creation of the Public Service Board, Commissioner Maltbie has devoted the bulk of his time to a study of the gas situation in the city; and, as a result, the Commission feel confident of their ability to prove that the 80 c. gas law is not confiscatory, and therefore not unconstitutional. In the suit decided by Judge Hough, the City of New York, the District-Attorney, and the Attorney-General were made defendants.

The report of the Special Master was made upon the following contentions by the Company: That the 80 c. gas law is confiscatory; that the two Statutes taken together are unconstitutionally discriminatory; that the penalty clauses are so oppressive as to be unconstitutional; and that the legislative power was by the Statute creating the Gas Commission improperly and unlawfully delegated to that body. The Master declared that the penalties fixed by the law were unexampled—that on the price of gas alone exceeding $4,680,000,000 per annum, or 50 times the assets employed in the business. The Master's report set forth that the value of the property on which the Consolidated Company were entitled to a return was $83,357,000, including $20,000,000 for the franchise and goodwill. The net earnings of the Company in 1905 were $4,983,928. During that year, 13,283 million cubic feet of gas were sold. Computing from these figures, the report asserts that a return of 2·8 per cent. would be yielded on the complainants' entire assets, and 3·6 per cent. on their assets exclusive of franchises and goodwill. This, he declared, was not, in his judgment, a fair or reasonable return on the value of the property.

While Judge Hough's decision practically upheld the Master's report and the Company's contention that the 80 c. law is unconstitutional and confiscatory, it is held that it weakens the position of the Company in several important respects. The Company claimed that they had $84,000,000 of tangible assets, and $30,000,000 of intangible assets represented by the value of the franchises. They used these figures to show that at an 80 c. rate they could not earn a fair profit on their investment, and that therefore the law was confiscatory. The Referee reduced these valuations in his report to $63,357,000 for the tangible assets and $20,000,000 for the franchises—making a total of

$83,357,000, instead of the Company's total of $114,000,000. Judge Hough made a material reduction in these figures. He places the tangible assets at $47,000,000, and the value of the franchises at $12,000,000, or a total of $59,000,000, which is only a little more than half the Company's figures. He values the tangible assets as follows: Real estate, $11,155,845; plant, $15,500,000; mains, $12,636,000; services, $1,994,000; meters, &c., $4,100,000; and working capital, $1,616,000—making a total of $47,001,845. He also makes reductions in the cost of manufacturing and supplying gas. The Company alleged that the annual cost was $8,746,265. Judge Hough eliminates from this the "net cost of gas purchased from other companies," amounting to $893,432. He also cuts down the item "interest on taxes" from $94,053 to $29,071. His decision makes the operating cost $6,799,147 instead of $8,746,265.

Judge Hough holds that on the foregoing figures the Company's income would be $3,030,000, or less than 6 per cent. on a total of $59,000,000—6 per cent. of $59,000,000 being $3,540,000. This margin is so small that Senator Alfred R. Page, who introduced the 80 c. Gas Bill, Attorney-General Jackson, and the Public Service Commission are confident that, on an appeal, they will be able to show that the Company can earn a fair return on their investment by furnishing gas at 80 c. They do not regard Judge Hough's decision, in view of the valuations he fixes, as detrimental to the cause of 80 c. gas, but, on the contrary, believe he has supplied a basis for a successful fight in the higher Courts.

In arriving at his figures, Judge Hough says he refused to take into consideration the Company's income during the past twenty years, or the price of the Company's stock in the past—declaring that they were not useful facts in the present situation. He considers that the monopoly held by the Company is beneficial; saying: "Such a business situation is secured against competition because the monopoly is beneficial. To have the streets of Manhattan torn up to afford room for the mains of a rival is unthinkable."

GAS-WORKS FOR FAZAKERLEY.

Local Government Board Inquiry.

Major J. Stewart, R.E., a Local Government Board Inspector, held an inquiry in the Municipal Offices, Liverpool, last Wednesday, relative to the Corporation's application for sanction to borrow £25,000 for the purpose of erecting gas-works to supply the district of Fazakerley.

The Town Clerk (Mr. E. R. Pickmere) presented the Corporation's case, and explained that at present some of the inhabitants were supplied with gas through the Liverpool Land Company and Mr. W. P. Hartley. By an exchange of land and arrangements with the Lancashire and Yorkshire Railway Company, a suitable site for the proposed works was secured, and the Railway Company were given access to sidings which they so much desired. The works would be constructed with an output capacity of 30 million cubic feet per year, with the possibility of extensions to produce 150 millions. The cost of land, the plant, and engineers' and other charges would amount to about £20,000; leaving £4000 or £5000 to provide for future necessary development. It was proposed to take over the mains, lamp-standards, lamps, meters, &c., belonging to the Land Company and Mr. Hartley at a figure representing their original cost, less 5 per cent. for depreciation—amounting roughly to £2500.

Evidence was given by Mr. Isaac Carr in support of the scheme, for which he has been responsible. In answer to the Inspector, he said he contemplated extensions within the next few years—some in twelve months, and others in three or four years.

The Inspector expressed the opinion that the Local Government Board would not be disposed to allow so large a sum as £4000 or £5000 as provision for future extensions; and upon his suggestion the Town Clerk reduced the total amount asked for to £21,000.

Alderman Fred. Smith and Mr. Boote (the Chairman of the Lighting Sub-Committee) supported the application as a means of providing facilities for the better development of the district.

Several property owners offered opposition on the ground that the exchange of land between the Corporation and the Railway Company would bring the sidings nearer than they anticipated to their property and to its detriment. They stated that they had bought their houses on the understanding that a "Garden City" was to be formed there. In reply, the Town Clerk remarked that their grievance could not be against the Corporation.

This concluded the inquiry.

GAS-WORKS EXTENSION AT TIVERTON.

Great progress has been made by the Tiverton gas undertaking the last few years; and at a meeting of the Town Council yesterday week, the Lighting Committee presented a report recommending the provision of further plant to enable them to cope with the increasing demand. Among the additional works required are a new and larger gasholder, a new station meter, a district governor, and a steam engine and boiler to take the place of the gas-engine at present in use. Mr. Clark Jeffery, the Gas Manager, estimated the cost of these improvements at £3500.

Alderman J. Thorne, the Chairman of the Committee, said that the success of the undertaking made this expenditure necessary. The expansion of the works the past three years had been phenomenal. They had now 1299 consumers, of whom 664 used prepayment meters, and 635 ordinary meters. This was double the number they had eleven years ago; while the make of gas had increased in the same period from 29,300,000 cubic feet to 40,500,000 cubic feet, despite the fact that the lace factory which had been their largest customer had adopted electric lighting. The increase in the consumption last year was 9½ per cent. Owing to this increase in the demand, and the inadequacy of storage, it was difficult during this winter to maintain the pressure necessary for the supply of outlying parts of the town. The capacity of the present holder was 95,000 cubic feet; but only 50,000 cubic feet could be supplied under pressure, and they ought to have storage room for 200,000 cubic feet. The governor and station meter had been in use since 1860, when the works were erected, and needed replacement by plant of larger capacity. The Lighting Committee had every confidence in the soundness of the Gas Manager's advice.

In supporting the recommendation, Alderman Amory said that many people in the higher end of the town could not have gas under present conditions. The Manager estimated that the substitution of a steam-engine for the present gas-engine would effect a saving of £80 a year. Mr. Jeffery added the explanation that steam was needed at the works for cleaning out pipes and other purposes; while under a boiler they could consume much small breeze and ashes which had now to be given away. Two or three members objected to the proposed expenditure, on the ground that it was not necessary, and that the limit had been reached in the demand for gas.

In reply, Alderman Thorne said that the extra demand was not entirely due to the slot meters; while as to the argument that the limit of consumption had been reached, a man in trade who did not anticipate and try for new business might as well put up his shutters. Owing to improved methods of lighting, and the greater use of gas for cooking and heating, the consumption had greatly increased during recent years. He did not agree that the limit of consumption had been reached; and it was a fact that the capital of the undertaking, even with the additions proposed, stood at a very moderate sum.

The Committee's recommendation was adopted by 15 votes to 3; and it was decided to apply for sanction to borrow £4000, to cover the cost of the proposed works and the extension of the mains.

THE PROPOSED FEDERATION OF POTTERY TOWNS.

Local Government Board Inquiry.

At the North Staffordshire Hotel, Stoke, Major Norton, one of the Inspectors of the Local Government Board, recently held the official inquiry into the scheme for the federation of the six Pottery towns, to which reference has already been made in the "JOURNAL." The inquiry was asked for by the county borough of Hanley and the boroughs of Longton and Stoke, who proposed that the three boroughs, with Burslem and the urban districts of Fenton and Tunstall, should be united in one county borough, and that the Local Government Board should make a Provisional Order to this effect. The three authorities, however, were not agreed upon the financial details. Longton and Stoke made a joint representation to the Local Government Board in which they asked that a scheme drawn up by Alderman Geen, a member of the Stoke Corporation and the Chairman of the Gas Committee, should be made the financial basis of federation. Hanley, in a separate representation, put forward a scheme of which Mr. J. S. Goddard, of Fenton, is the author. Shortly stated, Alderman Geen's proposal was that for a period of twenty years there should be differential rating; each of the six towns being a rating area. Each town possessing gas and electricity works would retain them during the period named; and the only common charges would be those for higher education, the existing main roads, and administrative charges. At the end of the twenty years all income and expenditure would be common, and uniform rates would be levied throughout the new borough. Mr. Goddard's scheme would hasten the process of complete federation. Under it, all the municipal gas and electricity works would be taken over at once by the new borough at a valuation, and elementary education, as well as higher education, would be a common charge from the beginning.

Three of the districts affected did not sign either representation. Fenton took up a neutral attitude, and, while not definitely committing itself as to the principle, said that if federation was to be compulsory it preferred the Stoke to the Hanley scheme. Tunstall was also neutral, though a poll of the ratepayers a few weeks ago showed a majority in favour of federation. At Burslem the poll went against federation, and the Town Council gave effect to the decision by instructing Counsel to oppose both schemes; but at the opening of the inquiry they withdrew, on the ground that the Inspector had already expressed himself in favour of federation, and was therefore not an impartial judge. The only public body actually opposing federation was the Staffordshire County Council, who wished to guard the county area against the loss of a very great amount of rateable value. A large array of Counsel was engaged. Mr. Balfour Browne, K.C., and Mr. B. C. Brough represented Hanley; Mr. C. C. Hutchinson and Mr. Allen, Tunstall; Mr. Vesey Knox, K.C., Fenton; and Mr. Danckwerts, K.C., and Mr. W. J. Disturnal, the Staffordshire County Council. Longton and Stoke were represented by their Town Clerks (Mr. G. C. Kent and Mr. J. H. Ashwell).

At the outset, the Inspector expressed regret that the preliminary conferences which had been held with a view of agreeing upon a financial basis had not been more fruitful; but he still hoped that it would be possible to arrive at a basis which would be satisfactory to all the parties.

Burslem having withdrawn, the case for Longton was taken. Mr. Kent confined himself mainly to the principle of federation; leaving it to the Stoke representatives to deal with the financial proposals. He pointed out, however, that a majority of the towns were in favour of Alderman Geen's scheme, and that it had been considerably modified with the view of meeting the wishes of Hanley. The proposal for differential rating for twenty years was a compromise suggested in a spirit of give-and-take. Sooner or later federation was bound to come; and everything pointed to the fact that the time had arrived. Mr. Boden, the Borough Treasurer, gave evidence as to the financial position of the town, and several witnesses were called in support of the general principle of federation.

At the close of the Longton case, the Borough Treasurer of Stoke put in statistics in regard to the finances of that town; and Alderman Geen explained in detail his scheme of differential rating. He was

under cross-examination by Mr. Balfour Browne, on behalf of Hanley, when the proceedings were adjourned.

On the second day of the inquiry, Alderman Geen was further cross-examined by Mr. Balfour Browne; his questions being directed to showing that the scheme brought forward by Sir Hugh Owen several years ago was the preferable one, and that it was desirable and possible to have an earlier general application of federation than the twenty years suggested. With regard to the transfer of the existing gas and electricity undertakings to the new borough, witness said he did not see the slightest difference between a private company parting with their works to a corporation, and a corporation parting with their undertaking to their own partners. He was distinctly of opinion that there must be a general amalgamation or none at all, and that Stoke would be no party to a scheme which included only Hanley, Stoke, Fenton, and Longton. Witness was submitted to a long cross-examination with respect to the Stoke Gas-Works, from a financial point of view; and the general question of the transfer of the gas and electricity undertakings to the new borough was discussed at great length.

Mr. J. S. Goddard then gave details of his scheme, and Mr. Balfour Browne opened the case for Hanley. He said the borough was favourable to federation, though it had not a great deal to gain from it. He contended that Alderman Geen's scheme was a sham one, and said Hanley considered that if federation took place it should be immediate and complete. With regard to Mr. Goddard's scheme, he said it was only included in the Hanley representation in order to illustrate a principle. It was not accepted as a settlement of the financial basis, which Hanley preferred to leave to the Local Government Board. At the close of the learned Counsel's remarks, Mr. Walton Stanley was called, and stated that Hanley's proposals were based upon Sir Hugh Owen's scheme. He considered that there should be full federation at once; that there should be a flat-rate; and that what was called a differential rate should be differential only for the purpose of adjusting differences of assets and liabilities between the various towns. The witness was cross-examined by Mr. Vesey Knox with the view of showing that the new scheme would be favourable to Hanley but unjust to Fenton; but he denied that there would be unfairness.

When the inquiry was resumed next morning, Mr. Balfour Browne brought up Hanley's new proposals for a financial basis, which were an extension of the scheme which Sir Hugh Owen recommended to the towns some years ago. In the first place, all the liabilities and assets of the six towns would be taken over by the new borough. The net assets of each town would be arrived at by deducting the amount of outstanding loans and all other liabilities from the value of the properties and effects possessed by the town; and these net assets would represent the amount of the purchase money to be paid or credited to the town. It would then be ascertained how much of the total net assets each borough would have had to bring into the partnership if its contribution had been based on its rateable value, and the differences would be adjusted by means of differential rating for a period of ten years. The value of the properties of the different towns would be ascertained by valuation; the valuer to be Sir Hugh Owen, or such other person as might be agreed upon, or, in default of agreement, nominated by the Local Government Board.

In the closing proceedings, it was intimated that Tunstall would now join Hanley. Mr. Vesey Knox, on behalf of Fenton, strenuously opposed the scheme; and Mr. Kent stated that Longton would adhere to the Geen scheme. As representing the Staffordshire County Council, Mr. Danckwerts supported the Hanley scheme, which he said came nearest to fulfilling all requirements. He concluded by expressing the hope that the President of the Local Government Board would not listen to Alderman Geen's scheme.

The inquiry then closed.

PUBLIC GAS LIGHTING CHARGES IN ST. PANCRAS.

Abandonment of the Average Meter System.

At the Meeting of the St. Pancras Borough Council last Wednesday, the Chief Clerk submitted a report with reference to the average meter system of charging for the gas supplied to the public lamps. He said there were in the borough six meters on which a calculation in regard to lamps charged on scale rates at 4·25 cubic feet per hour could be based; and during November last the average consumption of each of these meters was 1841·83 cubic feet. There were 425·25 lighting hours; so that the consumption was equal to 4·33 cubic feet per hour per lamp. If the supply was upon the average meter system, the charge would be based upon these figures, whereas under the scale system the consumption for each lamp was charged at 4·25 cubic feet per hour; showing a saving by the latter system of 0·08 cubic foot per hour. There were about 1000 incandescent lamps charged under the scale rate of 4·25 cubic feet per hour, and burning 3808 hours per annum; so that the yearly saving would be 0·08 × 1000 × 3808 = 304,640 cubic feet of gas per annum. At 2s. 5d. per 1000 cubic feet, this would equal about £37 per annum. On 350 incandescent lamps charged at a scale rate of 3·75 cubic feet per hour there would also be a saving; but the actual sum could not be accurately estimated, as no meters were fixed to these lamps. Under the average meter system, the Gaslight and Coke Company would require a meter to be put down for every 20 of these lamps, so that about 60 additional meters would be wanted, at an average cost of £6 each; and, further, the Company stated that they could not continue charging the flat-flame lamps on the meter system unless the three meters at present fixed for these lamps were increased to 16. As there were now only about 255 flat-flame lamps remaining, compared with 3300 when the average meter system was introduced, the Chief Clerk expressed the opinion that it would be to the advantage of the Council to abandon the average meter system and revert to the scale system of charge, and so save further capital outlay and the cost of the upkeep on meters and an annual saving in the consumption of gas. It was decided that the resolution passed by the Vestry in 1873 with regard to payment for gas for the public lighting being on the average meter system should be rescinded, and the scale system of charging adopted.

HEAVY WATER CONSUMPTION IN LIVERPOOL.

Effects of the Frost and Waste.

At the Meeting of the Water Committee of the Liverpool Corporation last Tuesday, the Water Engineer (Mr. Joseph Parry, M.Inst.C.E.) stated that there had been a large increase in the consumption of water in consequence of the recent frost. The total quantity consumed during the week ending the 11th inst. amounted to 263,403,000 gallons—being an increase of 84,428,000 gallons, or 47 per cent., on the consumption in the corresponding week last year. A remarkably rapid thaw took place on the night of the 5th inst., which produced a great number of leakages from lead pipes which had been burst by the frost. These leakages were chiefly in the backyards and the outside conveniences of dwelling-houses, and every effort had been made to stop the leakages as the reports reached the complaints office, and as they had been discovered by inspectors and others sent out for the purpose. The total number of leakages from lead pipes dealt with during the week had been 2852; and in addition to these, there had been, since the frost commenced, 96 cases of iron pipes (chiefly small distributing mains) broken. The escape of water from leakages and from taps left open to prevent freezing had had the effect of reducing the pressure over nearly the whole of the area of supply; but this was being greatly improved as the leakages and waste were stopped. In order to supply the large volume of water consumed during the week, and to maintain pressure in the service reservoirs, all the pumping-engines had been kept at work and the full quantity of filtered water available brought forward. Notwithstanding this, the stock of water in the Prescot reservoirs had been reduced by 57 million gallons; and to replace this quantity of water would be a slow process under present conditions. The difficulties were increased the preceding week by a fracture on the Rivington pipe-line, to repair which it became necessary to shut off the Rivington supply from Liverpool for about three days.

Colonel Porter (the Deputy-Chairman, who presided) remarked that on one day the consumption was more than 42 million gallons, against 26 or 27 millions, the daily average. In addition, they had the misfortune of a burst in the Rivington pipe-line. The accident emphasized the enormous advantage of the second pipe-line to Vyrnwy. They had drawn as much as 158 million gallons of water in the course of one week. They had been taking about 24¼ million gallons a day from Vyrnwy; and they would have been in a precarious position but for the second pipe-line.

A member of the Committee asked if people were justified in allowing water to run from their taps to prevent freezing. The Deputy-Chairman replied that they certainly were not. Mr. Parry said the practice was a common one, and it was a very effective way of preventing freezing; but only a mere trickle was required. The result of people leaving their taps open so freely, and he was afraid of plumbers advising people to do so, was that a large quantity of water was drawn off, and this prevented other people getting a supply, because the water would not rise in some districts to a sufficient height to fill the cisterns, on account of the reduced pressure. Leaving taps open and the water running was an offence against the Water-Works Clauses Act; and people were liable to be fined for it. A member remarked that if the water was not allowed to run the pipes would burst. Mr. Parry said the answer to that was that the pipes ought to be protected from the frost.

WEST BRIDGFORD AND ITS WATER SUPPLY.

An Independent Scheme.

Among the notices given for Bills to be promoted in the forthcoming Parliamentary Session, as recorded in the "JOURNAL" at the time, was one by the West Bridgford Urban District Council, who, it was explained, seek authority to construct water-works and pump, collect, and distribute water. The area is at present supplied by the Nottingham Corporation; and about twelve months ago discontent arose from the fact that the City Council proposed to raise the charges for water to West Bridgford consumers by 12½ per cent. Regret was expressed that West Bridgford alone, out of the whole area of the Corporation supply, should be singled out for an increase; and the ratepayers empowered the District Council to take preliminary steps to obtain an independent supply. The present scheme is the outcome; and under it the Council propose to acquire from the Corporation of Nottingham so much of the water undertaking as is situated within their own district, in addition to providing themselves with a pumping-station, well, and reservoir.

The subject was referred to at the meeting of the Nottingham City Council the week before last. Alderman Fraser explained that a Special Committee had been formed to oppose the passing of the Bill of the West Bridgford Council. This Committee, he said, had had a very long negotiation with the Urban Council, conducted on both sides in a neighbourly and conciliatory manner, with a view to arriving at a suitable compromise, and saving the ratepayers the unnecessary expenses of a parliamentary contest. He was not at liberty to state to the Council the nature of the negotiations, because they were confidential; but, in the result, they offered to abandon the surcharge at present made upon West Bridgford, and to place them on exactly the same footing, as regarded charges and other conditions, as ratepayers in the city. In doing this, the Council had gone to the limits of generosity; and he was not at all sure, while they had a legal right to a surcharge, that they had not gone almost too far in agreeing to give it up in order that peace might be secured. At the same time, he felt the members of the City Council were desirous that the dispute should be ended as quickly as possible, and that their relations with West Bridgford should be of the best. The Committee were now awaiting the result of the offer; and were hopeful that the terms would be accepted, and peace effected. The Council would understand that they were prepared for war, if necessary, though they were using every effort to obtain a suitable settlement.

These hopes of "peace," however, it seems are not yet realized; for

at the statutory meeting of West Bridgford ratepayers, held the same evening for the purpose of considering the Bill, a resolution consenting to its promotion was carried, amid loud applause, with only two dissentients. In explaining the matter, the Chairman of the Water Committee (Mr. T. Barlow) pointed out that a poll of the ratepayers which had been taken resulted in 1220 voting for going on with the scheme it was thought advisable to promote, 92 voting against it, and 14 being neutral. In face of this overwhelming evidence of the determination of the ratepayers to go in for their own supply, and of the strong resentment shown at the attitude of the Corporation, the Council felt that they had no option but to proceed with the scheme. They were advised that by the scheme they could obtain a sufficient quantity of water (and of a quality equal to that they were now being supplied with), and make a good profit on the present charges. The scheme, too, did not alone provide for immediate requirements, but contemplated future demands; provision being made for a population of 20,000. So that, with very little further outlay on the capital charge, a greater profit would most likely be made. The Council had used their utmost endeavours, both by letter and interview, to induce the Corporation to lower the charges to the Nottingham level, always without result—in fact, they had not only been rebuffed, but, he would almost say, insulted. Certainly they had not been received in the past with that courtesy that they were entitled to expect from representatives of a large Corporation, though the last interview was of the pleasantest description—perhaps as agreeable as could be desired. In conclusion, he remarked that what they sought was simply to make an ordinary business bargain as business men; and he appealed for the unanimous support of the ratepayers in order that their case should not be weakened, and that they should have full power to obtain the terms necessary to them from the Corporation, or, failing that, to proceed with the Bill.

On being asked to give the meeting an outline of the scheme, the Engineer (Mr. W. H. Radford) deprecated any suggestion that the differences between Nottingham and West Bridgford could not be settled amicably. At the same time, he said he did not think the Corporation should take the view that Nottingham should have everything. There was reason for Bridgford holding that any profits made from the supply of water to them were their natural birthright. His conviction was that there could be no doubt about the success of the proposed well at Holme Pierrepont, and of the scheme in general; and it was difficult to understand how Nottingham could seriously oppose the carrying out of an agreement which they willingly entered into years ago, and go to Parliament with quibbles and excuses, simply because the rights they wished them to surrender had become profitable. He could not see how they could hope to succeed in such a contention; and the offer of the Corporation to put Bridgford consumers on the same level as those in the city was one of the best proofs that the District Council really had an excellent case. The offer meant a reduction of over £1000 a year; and it showed that the District Council had acted wisely in taking the stand they had. In his own view, it would be better to get the Bill, if they could, rather than accept this offer, because the water rights were a valuable thing, particularly in a place increasing at the rate that Bridgford was. There was always a risk of them not getting a Bill, though he thought it was very slight; but if they could be quite sure of getting it, the best thing would be not to make any settlement at all with Nottingham.

LINCOLN WATER BILL APPROVED.

At a public meeting, the ratepayers of Lincoln have sanctioned, with one dissentient, the promotion of the Bill by which the Corporation seek further powers with respect to their water undertaking. The Mayor (Mr. J. Mills), who presided, remarked that, after consideration of a dozen schemes, the Corporation came to the unanimous conclusion that the one adopted was the best.

The proposals were explained at length by the Deputy Town Clerk (Mr. W. T. Page), who pointed out that a commencement was made with the bore at Boultham, with results which were common knowledge. The bore was distinctly successful, so far as the engineering work was concerned. No one could foresee that they would pierce at this great depth a large quantity of lime or gypsum, which made the enterprise disastrous. The work cost £33,300, of which £5500 had been repaid. In a few years, they would have forgotten the experience. The Corporation had determined that no surface supply, liable to contamination, should be adopted. Having referred to the disinclination of the Corporation to utilize water from the Lincolnshire limestone, he spoke of the overtures of the South Lincolnshire Water Compnay, whose action he criticized. The Elkesley supply, he said, presented no engineering difficulties. It would cross the Trent by a light iron bridge. The scheme would cost £180,000; and the Corporation owed to-day about £90,000. In addition, the Corporation were spending some £53,000 in reserve accommodation. All these amounts put together made a very heavy sum; and it might be asked how the expenditure would affect consumers. Now, the consumer was paying for water 1s. 3d. in the pound for a domestic supply. But they were at the present time spending 1s. in the pound out of the ratepayers' money for outlay connected with improvements in filtration, steam-engines, and other things. The total cost for water to-day was thus 2s. 3d. in the pound; and if the Corporation had the Elkesley water to-morrow, the expense would be identically the same. There would be a differential rate for residents outside the city, so as to lighten the burden which would fall on the citizens. In conclusion, he reminded the meeting that there was at present only accommodation for storing one-third of a day's supply.

It was reported to the Harrogate Town Council at their monthly meeting that the Local Government Board had sanctioned £89,200 of the £100,000 loan for the completion of the water-works, on the understanding that any sums raised under the loan should not be used for the payment of interest; and it was resolved to forward an undertaking to this effect to the Board.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The action by Messrs. Jas. Muir and Son, Limited, against the Edinburgh and Leith Gas Commissioners, in which a claim is made for £15,000, as damages for the pollution of the second well in the brewery of the pursuers, was expected to have been before Lord Johnstone in the Court of Session yesterday for discussion. It was not, however, reached, and, according to the opinion of the officials in his Lordship's Court, the state of business is such that it may be several weeks before it will be heard. It is possible that it might have been heard before now, but there was no disposition, at least on the part of the Commissioners, to press for a hearing, because time is on their side. On the part of the pursuers, too, there was an expectation of a settlement being come to; and they were not in any hurry. The Commissioners had tendered £4000; and the pursuers, while regarding this sum as inadequate, were in hopes that they might get the Commissioners to increase the tender to an amount which would satisfy them. The Commissioners declined to do this, and withdrew their tender; and so it was agreed that the action should go on. I understand that time is in reality being found to be on the side of the Commissioners, as is shown by the improving condition of the water. The Commissioners have succeeded in rooting out the source of pollution, and in removing as much as possible of the already polluted material. This being so, every day the pollution going into the well is lessening. Already the water is almost fit for brewing purposes. The longer the delay, therefore, the damages ought to diminish; they cannot increase.

The Eastern District Juniors this evening had a more than usually interesting meeting—a circumstance which was due, in great part, to the presence of two of their honorary members. The question of whether or not it is an advantage that the honorary members should take part in the work of the Juniors is a good deal discussed. If they are absent, some of the ordinary members think they have more freedom to express themselves; while, if they are present, the more timid of the ordinary members sit silent, and take no part in the proceedings beyond listening. If a perusal is made of the remarks by Mr. A. Waddell and Mr. J. W. Napier at the meeting this evening, it will be apparent that, whatever these gentlemen may have gained from the paper which was read, their contribution to the discussion of it must have been of much value to the younger members. There is another great advantage to the ordinary members in having their honorary brethren present, which is that those who nerve themselves to give their views upon the subject under discussion virtually advertise their capacity for the management of a gas-works to those who usually are consulted in the matter of filling up vacancies. To those of the Juniors, then, who are seeking advancement, the opportunity is given for showing what they can do; and the encouragement to them is to be more strenuous in their study of the subjects that are to come before the Association, so that when they rise to speak they may speak to the point in a common-sense, not a cavilling, way—making it clear that they are well posted up in the subject, and thereby making a good impression upon those who may (they do not know how soon) be in a position to help them to better their position. These remarks apply equally to the readers of papers; and upon this subject I should like to repeat what I have written before—that there is a tendency to make them too full. The paper by Mr. A. Morton Fyffe to-night, for example, was so long that he had to leave out part of it; and even when this was done, the time occupied was such that two subjects which had been put forward by the Council for discussion were perforce held over. It is true that the members were entertained to a treatise upon gas-works construction which covered, in considerable detail, the whole work of erecting gas-works, from the selection of a site to the finished works. It was a grand paper, full of much information which turned the minds of the hearers instinctively towards the personality of the author—an element to which much importance is to be attached—and from which the members doubtless derived more benefit than they would have done if they had discussed a shorter communication. Still, the policy of the Junior Associations would be a more profitable one if papers were cut down in length, and devoted to particular points with which the authors are specially familiar, and were not framed so as to cover the entire field of view upon that particular subject. This was the advice given by Mr. A. Wilson, of Glasgow, to the Juniors when the Association was formed; and it was sound advice, and well worth following. The shorter the communications, the more subjects would be handled; and the more the subjects handled, the greater would be the number of members who would benefit.

The Hamilton Town Council had before them this week once more the question of constructing a railway siding into the gas-works. The Gas Committee recommend that, in view of the difficulties experienced last year in getting in coal supplies, the construction of the siding should be proceeded with. After a discussion, the Council, by eight votes to seven, adopted the proposal of the Committee.

In the Edinburgh Town Council on Tuesday, on the report upon the illuminating power of the gas being submitted, Mr. W. W. Macfarlane asked what the position of the public would be in regard to the proposal to reduce the candle power of the gas. What would they be expected to do? Would they require to alter their fittings? Lord Provost Gibson replied that all that would be necessary would be the adoption of incandescent fittings. Judge Brown considered that it would be of the utmost importance if, before beginning to deal with the subject, they had some definite information with regard to the candle power of the gas supplied in the city. They were constantly told of the candle power at Granton, which was not the authorized place. The Lord Provost reminded the Council that Granton was the authorized place. The Council plunged into a discussion regarding the fitting up of a testing-station in the City Chambers, which had been agreed to. The question was asked why this resolution had not been given effect to. Lord Provost Gibson said he would make inquiry into the matter. This stopped the discussion; but notice of motion was given, to the effect that the Council representatives upon the Gas Committee be instructed to support the insertion of a provision in the new Gas Provisional Order, requiring that the standard candle power be determined

by tests taken within the City Chambers or a radius of a quarter-of-a-mile thereof.

On the evening of Monday last, it is reported, the members of the Broughty Ferry Town Council gathered in Brook Street to witness an experiment with an automatic lighting lamp. The explanation is given that the lamp was lighted by pressure controlled from the gas-works, and extinguished by a reduction of pressure (which is most probably incorrect). By the method, it is stated, the whole of the lamps in the burgh "might be lighted and extinguished simultaneously" (surely an extraordinary feat); thus effecting great saving in labour. The initial cost of each apparatus is over £3; and this, with the probable duration of the arrangement, are the points the Council will have to consider against the great economy in wages. The experiment was so far a success (a very guarded statement); and it is said to be likely that, during the winter, several lamps of this description will be put up and tried for some time, prior to any decision as to a general introduction being sought.

The Gas Committee of the Dumfries Town Council reported last week that the sulphate of ammonia plant in the gas-works had been completed, and that it was proposed to hold an opening ceremony in connection with it. It was agreed, on the recommendation of the Committee, to pay Messrs. Joseph Taylor and Co. the sum of £430; being their contract price for lead work in the erection of the plant. The Town Clerk was instructed to write to coal contractors, insisting upon delivery of the coal contracted for, and intimating that the Council declined to accept a substitute for it to any further extent.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Jan.* 18.

During the greater part of the week demand has been well sustained; but towards the close buyers have been less keen, and the tone has become rather easier in consequence. The closing quotations, however, remain £11 16s. 3d. per ton f.o.b. Hull, £11 18s. 9d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. While the bulk of the buying has again been for the purpose of covering January contracts, there has been some reselling at below current quotations. There has been a fair amount of inquiry from abroad for delivery over the spring months, but buyers' ideas still remain only on the level of spot prices, and in these makers do not find any inducement to sell ahead. There has been some speculative selling for late spring months, at about the level of the spot market.

Nitrate of Soda.

This article is quiet but steady at 11s. 1½d. per cwt. for 95 per cent., and 11s. 4½d. for refined quality.

Tar Products. LONDON, *Jan.* 20.

The markets are still generally quiet, and in most cases decidedly dull. Pitch is very quiet all round, and business has been done in several instances on the east coast at 20s. for delivery to June; while in Liverpool 19s. 6d. has been accepted. Continental consumers do not seem anxious to buy, and will only consider offers for a long period ahead. Creosote is steady, and prices are unaltered. Benzol 90 per cent. is quiet, and there is but little demand for it; while 50-90's and toluol are both quite neglected. Solvent naphtha is easy, and business has been done in London at 11d. per gallon. High-flash naphtha is quiet, and low figures have been accepted. Carbolic acid remains unchanged. Continental consumers refuse to offer more than 1s. 6¾d. f.o.b. east coast. Crystals are still neglected. Creosote salts and naphthalene are both very firm.

The average values during the past week were: Tar, 13s. to 17s., *ex* works. Pitch, London, 20s. 6d. to 21s. 6d.; east coast, 19s. 9d. to 20s. 3d.; west coast, 18s. 6d. to 20s., f.a.s.; Benzol, 90 per cent., casks included, North 8d. to 8¼d., London 8¾d.; 50-90 per cent., casks included, North and London, 8d. to 8¼d. Toluol, casks included, North 9¼d. to 9½d., London 9½d. to 10d. Crude naphtha, in bulk, North 3½d. to 3⅝d., London 3¾d. to 4d.; solvent naphtha, casks included, North 10d. to 10½d., London 11d. to 11½d.; heavy naphtha, casks included, North 10½d. to 11d., London 11d. to 11½d. Creosote, in bulk, London 2⅝d. to 2¾d., North 2½d. to 2⅝d. Heavy oils, in bulk, 3d. to 3½d. Carbolic acid, 60 per cent., casks included, east coast 1s. 6⅜d. to 1s. 7½d., west coast 1s. 6½d. to 1s. 6⅜d. Naphthalene, £6 10s. to £10 10s.; salts, 45s. to 47s. 6d., packages included and f.o.b. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

This article is steady, and there is a firm tone in the market. The principal gas companies still quote £12 5s., and outside makes £11 15s. to £11 17s. 6d. In Hull, £11 16s. 3d. to £11 18s. 9d. is quoted; the latter price was offered and declined for one of the best makes. In Liverpool, the figures are £11 17s. 6d. to £12; and in Leith, £12 1s. 3d. to £12 3s. 9d.

Saddleworth and Audenshaw Water Scheme Rejected.—A public meeting of the electors of Saddleworth, which was called to consider the promotion of a Bill to allow Saddleworth and Audenshaw jointly or separately to become partners with the Ashton and District Joint Water-Works Committee in their water undertakings past and prospective, resulted in the rejection of the proposals by a large majority.

High-Pressure Gas Lighting at Tonbridge.—The Tonbridge Gas Company have lately been showing the townspeople what can be done with high-pressure gas lighting; several lamps having been installed with highly successful results. They are of 750-candle power, and burn 20 cubic feet of gas per hour, which, at the Company's price, works out to about ⅝d. per hour, or half the cost of the so-called 1000-candle power electric lamps, which in reality give a greatly inferior light. The effect of the display has, we learn, been that the Company have received orders for a number of the new lamps.

COAL TRADE REPORTS.

Lancashire Coal Trade.

There is no change to report in the coal trade of the county. Steadiness is universal. In some parts, and especially in the Manchester district, colliery proprietors are really not able to supply the demands they receive. Coal is in the heyday of its prosperity. Only on Saturday, at a meeting of the Manchester Junior Gas Association, one of the speakers said that, in the present prosperous condition of the trade, colliery owners were so independent that they did not care whether they supplied gas-works at all. Whether in gas coal, house coal, engine fuel, or shipping, reports from every coal-supply centre are the same—all on the side of good demand. While there has been a slight increase in prices in the Wigan district, other districts remain on the September price list. An increase was expected on the Manchester Coal Exchange this month; but it has not been pronounced.

Northern Coal Trade.

There is a steady demand for coals; and as the collieries are giving a normal output, there is a heavy shipment. In steam coals, the price is very well maintained; best Northumbrians being from 13s. to 13s. 3d. per ton f.o.b., and second-class steams from 12s. to 12s. 3d. Steam smalls seem rather more plentiful, and the quotation is from 6s. 6d. to 7s. The gas coal trade is still marked by activity. The heavy production is well taken up; the exports of gas coals being very full for this season. The home demand is also good. Prices of Durham gas coals vary from about 12s. 3d. to 14s. per ton f.o.b., according to the quality; and best kinds appear to be relatively the firmest. Some of the Scandinavian contracts now seem to be settled, at prices near to those that are current, and therefore above those that were allotted a year ago. Other contracts are expected to be offered in this market from Sweden in the course of a week or so. Coke is steadier; but the abundance of gas coke makes it easy in price. From 18s. 6d. to 19s. per ton is being quoted as the f.o.b. price in Newcastle—a relatively good value.

Scotch Coal Trade.

The foreign buyer is the problem in trade at the present time. Orders from abroad are coming more freely than for some time past—the preliminary to fixing the season's contracts. The home consumption is still suffering from the closing of iron and steel works. Prices quoted are: Ell 13s. 6d. to 14s. 6d. per ton f.o.b. Glasgow, splint 13s. 9d. to 14s., and steam 13s. to 13s. 3d. The shipments for the week amounted to 138,359 tons—an increase of 26,767 tons upon the preceding week, but a decrease of 42,502 tons upon the corresponding week of last year. For the year so far, the total shipments have been 252,455 tons—a decrease of 26,233 tons upon the corresponding period of 1907.

Pressure and Quality of Gas in Wandsworth.

The General Purposes Committee of the Wandsworth Borough Council had before them at their last meeting a long report by their Gas Examiner (Mr. H. Wilson Hake) on the subject of the pressure of gas supplied in the borough. He said the regulation of pressure had hitherto been left to the gas companies, and there had been no interference on the part of the authorities except on the comparatively few occasions when the pressure had been below the minimum allowed by law. The ostensible reasons for increasing it were that this was necessary in order to convey the gas effectually to long distances, to meet extra and sometimes sudden demands for gas for cooking purposes and engines, and notably in time of fog. Mr. Hake pointed out that there were certain disadvantages to be noted in connection with excessive pressure, though he acknowledged that the limit at which it could be called excessive was not easily defined. Taking the usual variations into account, perhaps 4 or 5 inches might, under certain circumstances, be considered excessive, except as an initial pressure at the works. The disadvantages of high pressure were that loss of gas by leakage was caused to both suppliers and consumer; while in the case of the latter there was liability to explosion or poisoning. Having dealt with the various effects of excessive pressure and the means of dealing with it, Mr. Hake said perhaps a fair general appreciation of the facts would be the best remedy for any trouble arising; but even this did not enable varying pressure to be met at all times. He suggested that the Gas Company might consider a representation on the matter. It was decided to send a copy of the report to the Wandsworth and Putney and the Mitcham and Wimbledon Gas Companies, with a request that they would furnish some observations thereon. In another report, Mr. Hake stated that on the 2nd inst. he made his first official test of the gas supplied by the Mitcham and Wimbledon Gas Company at the new testing-place in Haydon's Road, South Wimbledon, under the Mitcham and Wimbledon Gas Act of last session, which came into force the previous day. He explained that under its provisions the standard illuminating power was reduced from 15 to 14 candles, and that the conditions of testing were somewhat changed—an open bar photometer being used, and a pentane lamp in place of candles, while the burner employed in the photometer was a "Metropolitan" argand No. 2, which had to be so adjusted as to obtain from the gas the greatest amount of light when burnt at the rate of 5 cubic feet per hour. The result of his test was that the illuminating power of the gas was 17·7 standard sperm candles, and the pressure at which it was supplied was 2·9 inches.

Suicide by Gas Poisoning at Brighton.—An unknown man took a room at a Brighton coffee-house last Friday week; and the following morning the landlord, failing to get an answer to his knocks, entered the room. There was a smell of gas; and an india-rubber tube was hanging down from a gas-bracket over the bed; the end being close to deceased's mouth. It was stated that deceased must have brought the tube with him to the place. The doctor called at the inquest said there was no doubt it was a case of deliberate suicide; and the Jury returned a verdict in accordance with this statement.

Award in the Warrington Water-Works Arbitration.

Mr. George H. Hill, M.Inst.C.E., has made his award in the arbitration proceedings between the Warrington Corporation and Mr. George Lawson, of Glasgow. In September, 1900, Mr. Lawson entered into a contract with the Corporation for the execution of certain work in connection with their water-works; the amount being £24,000, with allowances for contingencies, &c. Great delay took place in the execution of the work, and the Contractor was paid £35,484 on the contract; some of the items being subject to final adjustment. Being dissatisfied with the amount, he issued a writ against the Corporation, claiming £36,425 as the balance due to him under the contract. This made a total claim of £71,909. When the writ was issued, the Corporation took out a summons to have the action dismissed, on the ground that the Contractor was bound to go to arbitration under the terms of his contract. It was eventually agreed, by an order of the Court, to refer all matters in dispute to Mr. Hill. The Corporation counterclaimed for the sum of £8000. In his award, the Arbitrator has found that no money is due to the Contractor, but that he owes the Corporation £1432, which he orders him to pay, together with all the costs of the arbitration proceedings, and of the award. On the other hand, the Corporation pay the costs of the action in the High Court.

Gas-Firing for Potters' Ovens.

The "Staffordshire Sentinel," referring to the experiments carried out by Mr. W. Langford, the Engineer of the Longton Gas-Works, in firing pottery with town gas, at the usual daily pressure on the works, says: "It is interesting to recall that two years ago Mr. Langford was given permission to experiment with gas in connection with colour-firing; and the test was conducted by means of muffle furnaces. Several manufacturers were interested in the experiments; and the results were such that the Gas and Electricity Committee empowered Mr. Langford to extend the trials upon a larger scale. To do this, a potter's oven was erected at the gas-works; the usual principle and design being followed, only that the ordinary fire mouths were made into combustion chambers, the air for the support of combustion being allowed to enter in the usual way by slides. The ordinary town's gas was employed in the experiments; and there was no attempt to economize by adopting any regenerative advantages, and the pressure was left entirely to the possibilities of the gas under normal conditions. The results, both in the firing of earthenware and china, were considered very satisfactory; and no difficulty was experienced in attaining the greatest heat required. The ware appeared to be eminently satisfactory; and when the busy winter season of the gas-works is over, the experiments are to be continued, to further demonstrate the possibility of firing by ordinary gas under economical conditions." Readers will be aware, from notices that have already appeared in the "JOURNAL," that much attention is now being paid to the use of gas for pottery kilns.

Artesian Boring at the First Garden City.

Four years ago the First Garden City, Limited, had an artesian tube well, 14½ inches diameter, sunk 210 feet. Water was reached at a depth of about 90 feet from the surface, and an abundant supply was obtained of great purity. Deeming it advisable to provide entirely duplicate plant, comprising another well, deep-well pumping machinery, and engine, the work of boring the second well was placed in the hands of Messrs. Le Grand and Sutcliff, of Bunhill Row, London, who had made the first one. The chalk at the pumping-station is met within a few feet of the surface, and is known as the lower division of the middle chalk formation—the boring just reaching the Melbourn rock. The water level was found to stand at about 100 feet below the surface. A pumping trial extending continuously for 72 hours raised 400,000 gallons of water, during which time the water-works plant was also kept going. A few minutes after pumping had ceased it was found that the water had recovered its level, and it rose 18 inches higher by the following morning. It is therefore beyond doubt that the site chosen for the water-works is an excellent one, capable of providing amply for future requirements.

Reduction in Price to be Made at Keighley.

The Keighley Town Council have decided, on the recommendation of the Gas Committee, to make a reduction in the price of gas, as from July next, from 2s. 3d. to 2s. 1d. per 1000 cubic feet to ordinary consumers, with an equivalent concession to other users. In making the proposal, Mr. J. Harrison pointed out that last year's profits were £8760; and on this basis, making due allowance for contingencies, it was estimated that during the next three years £24,891 would be available. The reduced scale of charges, on the other hand, would lower the profits by about £2100 a year; but as the reduction would only commence next July, there would only be two years' reduction, or £4200—bringing down the available surplus to £20,691. The present plant was capable, with very little further outlay, of producing 50 per cent. more gas; and such an increase would mean a further reduction in price in a very short time. Mr. Howley moved, as an amendment, that the scale for penny-in-the slot meters should be 2s. 3d., instead of 2s. 6d. Mr. Brigg argued that it would have been a sounder policy to wait for some months, in order to see what was likely to be the actual price of coal next midsummer. They could not both eat their cake and have it; and cheaper gas must mean higher rates. It was desirable to preserve every possible source of income, with a view to make the burden of the rates as tolerable as possible. Only two members voted for the amendment.

The Lower Austrian Diet has passed a Bill sanctioning the raising by the Vienna Municipality of the loan of 300 million kronen for (*inter alia*) the extension of the gas and electricity works to which reference was made in the "JOURNAL" a fortnight ago.

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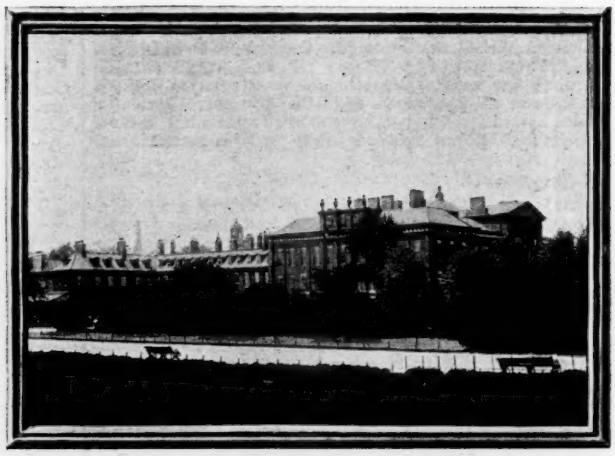

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Increase in Price at Sunbury.—The Sunbury Gas Company have written to the Urban District Council regretting that, owing to the increase in the cost of coal and other materials, they are compelled to raise the price of gas to consumers by 3d. per 1000 cubic feet. They hope, however, this will be only a temporary measure. The increase will not affect the public lighting.

Charge for Water in the City of London.—The Metropolitan Water Board have served notice upon the Corporation that the agreements under which the Board now supply water for various purposes to premises in the City will be determined on the 25th of March next, and stating that the supply will be continued on the existing terms until the end of that month; but that from the 1st of April the supply can be provided only on the terms prescribed by sections 16 and 18 of the Metropolitan Water Board (Charges) Act, 1907.

The Wombwell Gas-Works Explosion.—The inquest on the two men who died from injuries sustained through the explosion at the Wombwell Gas-Works last month (p. 924), which was to have been resumed last week, has now been adjourned for another month. The principal cause of this further adjournment is the illness of the third workman, Arthur Burns, who, a few weeks ago, so far recovered that he was permitted to return to his home. He has, however, lost two of his children by death during his illness; and this has contributed to the rather serious condition in which he is now stated to be.

Electric Light Failure in Paris.—The sudden and simultaneous extinction of the electric light on a large section of the Paris boulevards at six o'clock last Friday evening gave rise to reports that the electricians were again on strike. The interruption of the service, which caused great inconvenience—candles, oil-lamps, and other makeshifts, having to be resorted to—and necessitated the closing of many shops was, however, it is stated, due to an explosion at the generating station at Clichy, which caused considerable damage to the machinery. The work of repairing this was much impeded by the fact that the building itself was in darkness, and the repairs had to be effected by candle light.

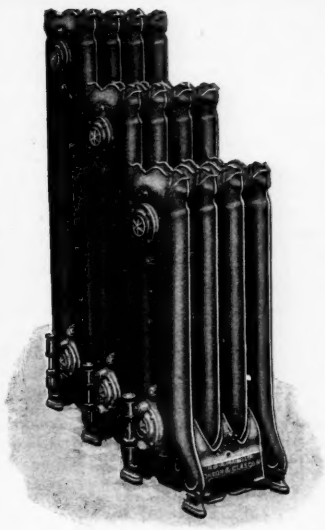
Alderman Gibson and Gas Profits.—Correspondence on "Gas Profits and the Rates" has been appearing in the columns of the "Manchester Courier;" and one letter championing the cause of the gas consumer as against the policy of handing over large sums in aid of the rates, has drawn the following spirited acknowledgment from Mr. Alderman Gibson, the Chairman of the Gas Committee: "Permit me to thank you for your letter in the 'Courier.' I have been working in that direction for years; but I have found very few supporters. It is a monstrous shame to forcibly take £1000 a week out of the pockets of the poor gas consumers to pay the rates of wealthy people—large ratepayers, who don't burn gas at all—little less than robbery. Talk about benefiti ng the ratepayers, nothing would benefit the ratepayers more than cheap gas."

Wombwell Urban District Council v. Dearne Valley Water Company.—It is stated that the taxed costs of the Wombwell Urban District Council in their recent unsuccessful action against the Dearne Valley Water Company amount to £3594; while the Company's costs (of which the Council have to pay half) come to £1926. The total sum which the Council will have to pay is thus £4551. A full report of the action appeared in the "JOURNAL" during last May and June (pp. 595, 751, and 825); and it may be remembered that it was brought to obtain a declaration that, under a certain agreement and an indenture, the defendants were bound to supply, and the plaintiffs were entitled to receive, all such water as the latter might from time to time require for the supply of their district (such water to be delivered to, and taken by, the plaintiffs in bulk through a meter at 6d. per 1000 gallons), and that the water supplied should be constantly laid on under pressure.

Southampton and Automatic Lighting.—At their recent meeting, there was submitted to the Southampton Town Council by the Works Committee a lengthy report on the subject of automatic gas lighting, recommending, after full consideration of Dr. Rostin's system, that the question be deferred for the present. Mr. Weston said the matter had been before the Council for twelve or eighteen months; and they now found that, after spending a large amount of capital, they could only save £136 a year on one scheme, and £315 on another. The Committee, therefore, thought it better to defer the whole matter. Mr. Tebbutt hoped that the question would not be shelved; pointing out that at the end of five years they would save £1000. He asked that the clause should be taken back in order that the Committee might have an opportunity of further discussing it. Alderman Hutchings said he was disappointed that the Committee had deferred the question on the ground that there was not sufficient inducement and not sufficient saving. Mr. Bonner was not in favour of introducing mechanism in order to displace men, unless it was worth their while. On a vote, the recommendation was agreed to.

National Property in Water.—At the annual general meeting of the Royal Meteorological Society last Wednesday, the President (Dr. H. R. Mill, the Director of the British Rainfall Organization) delivered an address in which he dealt with the subject of "Map Studies of Rainfall." Rainfall, he said, was not only the most difficult of all the meteorological distributions to map accurately, but also that one which was of the greatest importance, for by rain the rivers were fed, and the rivers both watered and drained the land. The problem of the rivers was becoming acute. The growing populations of the great towns were tapping the upper sources and diverting the water from its natural channels, and at the same time they were polluting the lower courses with the waste of the factories and the streets. He thought that at least as good an argument could be drawn from the consideration of physical geography in favour of supplying the great towns of the east from the large precipitation of the west, as could be drawn in the opposite direction from the artificial divisions of political geography. It seemed to him that care for the water supply of the country, coming as the water did from the air that knew no bounds across the land, was by no means a parochial, but in the fullest sense a national, matter, and should be dealt with in the interests of the nation as a whole; the units of subdivision, when required, being natural uni's of river basins.

RADIATORS



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Coke Fire at the Sheffield Gas-Works.—Early on Sunday morning, the local "Independent" says the fire-brigade were called out to a fire at the Sheffield Gas-Works. On arriving at the works, a heap of coke, 15 feet by 51 feet, and about 12 feet deep, was found to be alight at one end. The men soon got to work with four lines of hose; and the fire was quickly under subjection. It smouldered, however, for some time. The cause is attributed to the fact that the men who deposit the coke must have left some of it still burning; and this ignited a portion of the huge heap.

Wokingham Gas Supply.—At a recent meeting of the Wokingham and District Ratepayers' Association, reference was made to the increase in the town's expenditure. In four years, the cost of lighting by gas had gone up from £482 to £578. Speaking on the subject of the gas-works, Mr. W. T. Martin (a member of the Town Council) said that £6444 was borrowed for their purchase; new mains cost £1000; a gas-holder, £3503; and meters, cooking-stoves, &c., £2500—bring up the total borrowed capital to nearly £14,000. They had already replaced some of it, and instead of paying 5s. 6d. or 6s. per 1000 cubic feet for their gas, as they did before the purchase, they were only paying 4s. 2d. In answer to a question as to whether the works would be free from liability in 21 years, Mr. Martin said he was confident they would.

Hull Gas and Water Estimates.—The Hull Gas and Water Committee have had submitted to them the estimates for the coming year relating to the undertakings under their charge. The estimated income of the water-works is placed at £62,405, of which £39,607 will be derived from domestic and unmetered supplies, and £21,828 from metered supplies; the balance being made up of property rents, fees for testing fittings, and interest on credit balances. The expenditure is put at £30,000, which leaves a gross profit of £31,805, from which £15,993 will be deducted for sinking fund and interest, leaving a net estimated profit of £15,812. On the gas undertaking the income is estimated at £12,605, and the expenditure at £9635—leaving a gross profit of £2970. Of this, interest and sinking fund will absorb £2500, leaving a net profit of £470.

Gas Explosion at Bradford.—About noon on Monday last week a gas explosion occurred in Legram's Lane, Bradford, a working-class district. A woman named Mrs. Hudson detected a smell of gas during the morning, and sent for a plumber. After searching, he came to the conclusion that there was an escape from the main, and suggested that Mrs. Hudson should communicate with the Corporation Gas Committee. This was done; but before the escape could be stopped the gas had reached the fire in the house, and an explosion followed. The bedroom and kitchen floors collapsed, portions of the front and side walls gave way, and much damage was done. Several neighbouring houses were shaken. Mrs. Hudson was in her house at the time with her young son; and when the floors collapsed they both fell into the cellar. They only sustained slight cuts. After the accident, some employees of the Gas Department were quickly on the scene, and stopped the leak from the damaged main. A Mrs. Holdsworth, who was rendered unconscious by the explosion, has since died.

Islington Borough Council and the Meter-Rent Question.—At the meeting of the Islington Borough Council last Friday, the Parliamentary and General Purposes Committee reported that they had considered a communication which the Board of Trade had received from the Gaslight and Coke Company with regard to the reimposition of meter-rents. The Committee pointed out that the Council had expressed to the Board their opinion that a Government inquiry should be instituted into the administration and expenditure of the Company; and the letter referred to was in answer to a communication from the Board of Trade asking for the Company's observations thereon. The Committee thought it unnecessary to again bring this question in detail before the Council at present, having regard to the fact that the Company had intimated that the price of gas would be reduced from 2s. 11d. to 2s. 10d. per 1000 cubic feet as from the taking of the meter indices at the end of December quarter, which reduction would represent a larger sum than that which would result from the abolition of meter-rents. The Council approved of the action of the Committee in expressing to the Company the hope that the price of gas for public lighting would also be lowered at an early date.

Messrs. Aldridge and Ranken, of Westminster, have just received an order from the Imperial Continental Gas Association for two of their stoking-machines, to be erected at the Hoboken (Antwerp) Gas-Works.

The Newport (Isle of Wight) Corporation have made an application to the Local Government Board for permission to borrow £1290 for an independent rising main between the water-works, the pumping-station, and the high-level reservoir; the present single main for pumping and delivery being subject to noise and bursting from the pulsation of the engines.

Messrs. George Waller and Son, of the Phœnix Iron-Works, Stroud, have recently received orders for exhausting machinery for the South Metropolitan and Commercial Gas Companies, and (among other places) for Coventry, Leicester, Birkenhead (two), Derby, Cardiff (two), Bath, Walker and Wallsend (two), South Shields, Lancaster, Stoke, Doncaster and Toronto (two), Dunedin (two), Tokio (two), Yokohama (four), Nagoya (two), and Rosario (two); as well as for six large sets for coke oven bye-products plants, and a large number of smal sets.

It is reported that five men in the employ of Messrs. Docwra and Son had a narrow escape last Tuesday afternoon while engaged in deepening a well at the Barnet Water-Works. The well is 250 feet deep; and a gang of men were working at the bottom of it all the morning. At dinner time, five of them got into a skip, and were being drawn up by the steam gear at the surface, when suddenly the skip fell back to the bottom. They had gone 50 feet up the shaft when the fall occurred. It is understood that the accident was due to a pin in the gear becoming dislodged. One of the men was badly injured; and two others had to be attended to by a doctor.

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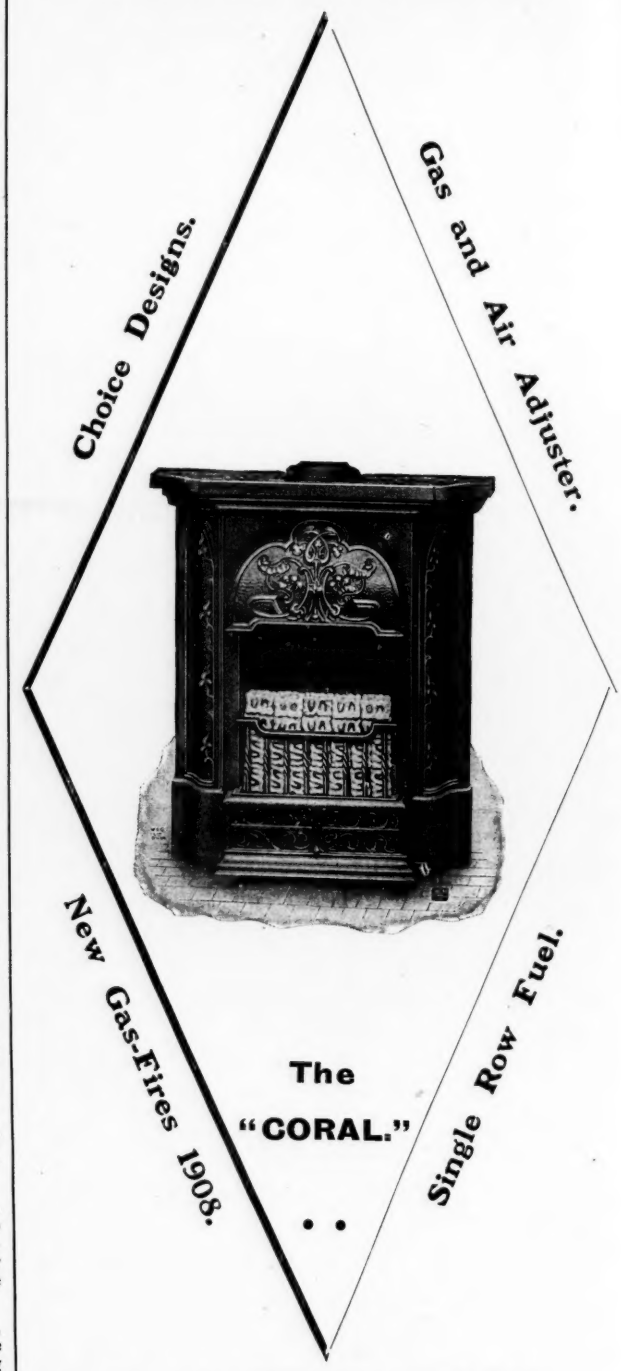

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